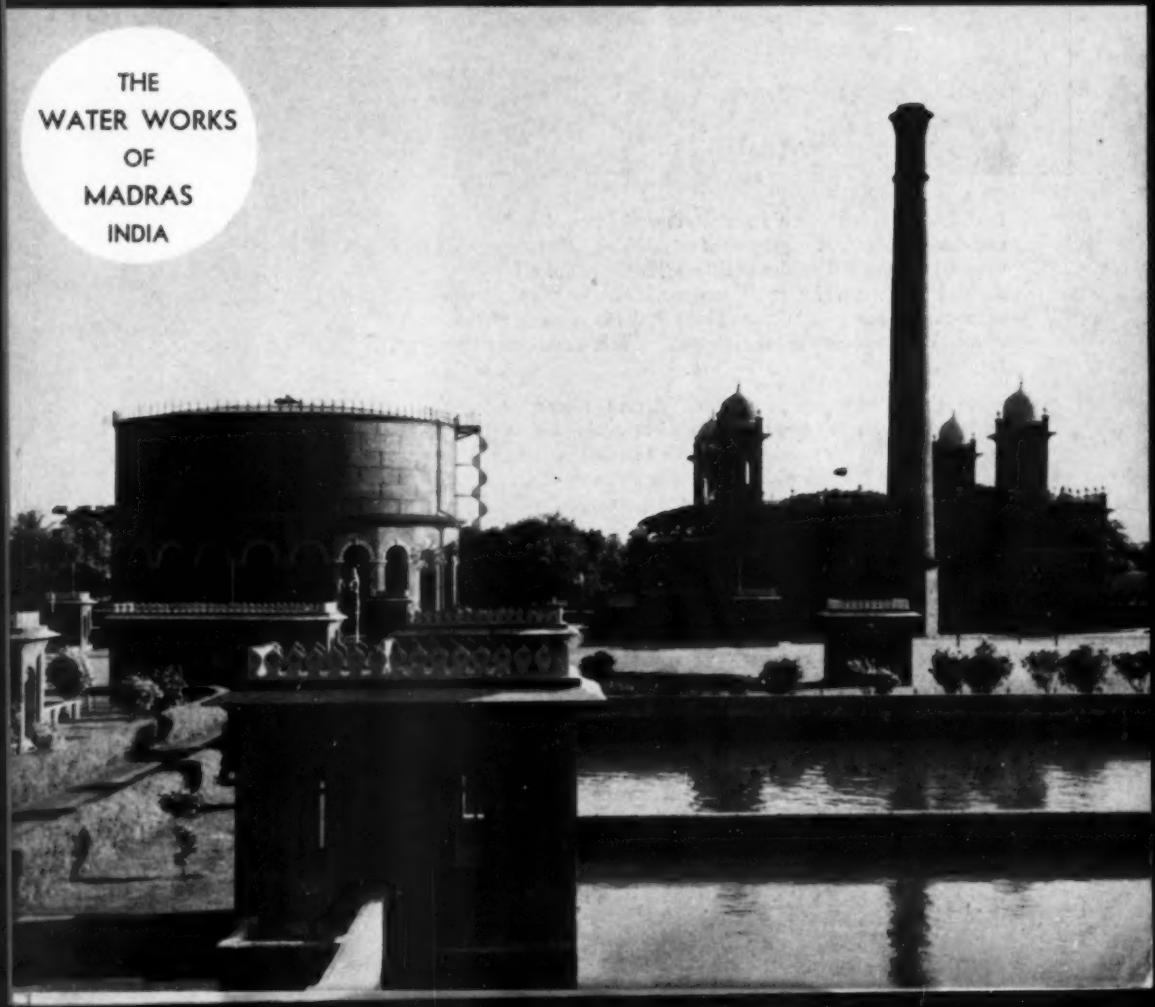
V. V. No. 8 AUGUST, 1960

WATER & SEWAGE WORKS

WATER SUPPLY SEWAGE DISPOSAL

INDUSTRIAL WASTE TREATMENT



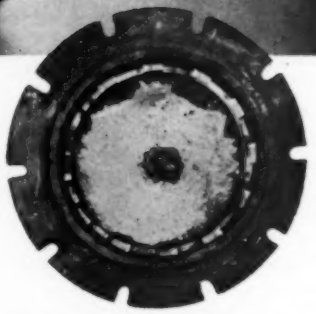
It's easy to tap!

LOCK JOINT
CONCRETE PRESSURE PIPE

Lock Joint Pressure Pipe of any design may be tapped easily and economically for the purpose of establishing either large connections or small service outlets. With the aid of a few simple instructions, any experienced service crew can apply the modern tapping technique which permits the making of connections in concrete pressure pipe while the line continues to operate under pressure.

Although, for many years, taps have been made successfully in concrete pressure pipe, today's efficient equipment and modern methods now make it possible to tap Lock Joint Concrete Pressure Pipe with even greater economy of time, money and effort, and without sacrificing strength.

At your request we would be glad to send you our booklet outlining the simple steps required in making a pressure tap in Lock Joint Concrete Pressure Pipe.



LARGE PHOTO: Tapping a 16" outlet in a 36" pipe at Wayne County, Michigan.

SMALL PHOTO: The pilot drill of the tapping machine withdraws the concrete core, making a clean cut, and leaving no obstruction within the pipe line.

Lock Joint Pipe Company for over forty years has specialized exclusively in the manufacture of reinforced concrete pipe for water supply and transmission mains as well as for sewers, culverts and subaqueous installations.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

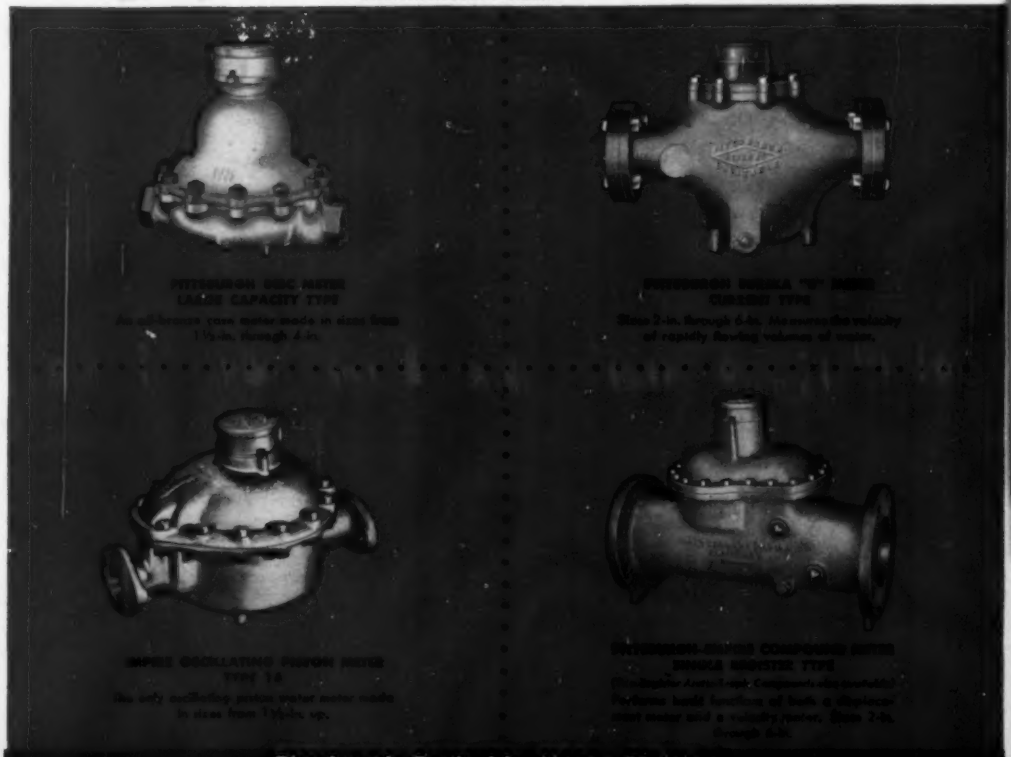
PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. Oklahoma City, Okla. • Tulsa, Okla.

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. August, 1950. Volume 97, Number 8. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second class matter March 4, 1948, at the post office at Mount Morris, Illinois, under Act of March 3, 1879. Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N.Y.

PITTSBURGH-EMPIRE
large capacity meters
RIGHT for the job—RIGHT on the job

Commercial, industrial and apartment house services are potentially big revenue earners. To get all this revenue you need the right type of meter on every job. Fitting the proper meter to the setting is an important part of Pittsburgh-Empire service. We alone make all types of water meters, thus we can give you our recommendations without prejudice and in your best interests. To get all the facts on how to collect all your revenue, write the nearest District Office.



Pittsburgh Equitable Meter Division

ROCKWELL MANUFACTURING COMPANY

Pittsburgh 8, Pa.

Atlanta Boston Chicago Columbus Houston Kansas City Los Angeles
New York Pittsburgh San Francisco Seattle Tulsa

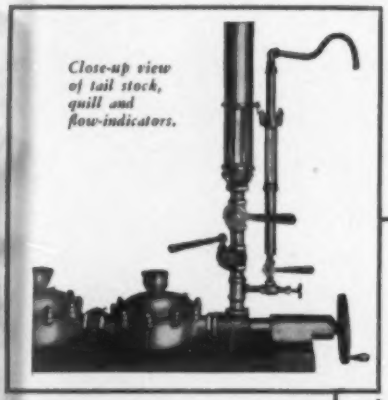
ADVANCED BADGER ENGINEERING brings you BADGER METER TESTERS

Make a place in your set-up for Badger Meter Testers. You need them . . . 1 — Because they faithfully record meter accuracies and help you to increase revenue . . . 2 — Because, with their Visible Rate-of-Flow Indicators, they accurately indicate rates of flow from 1/16-gallon to 160 gallons per minute . . . positively, not just proportionally . . . 3 — Because they act as insurance against water revenue losses.

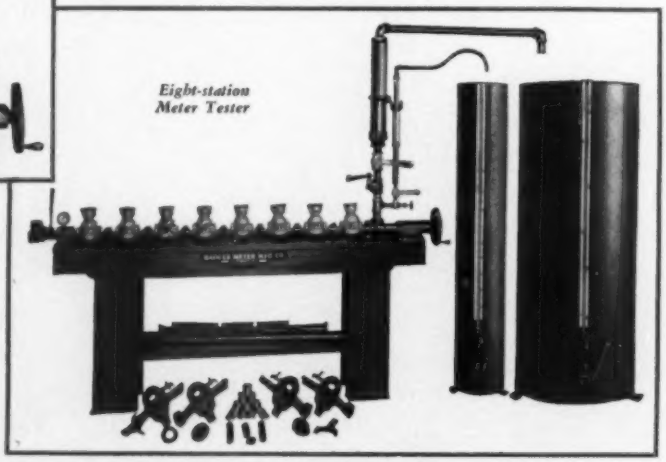
BADGER METER TESTERS are the only completely equipped testers made. NO EXTRAS TO BUY. Four sizes available . . . to handle two, four, six or eight ⅝-inch meters of any make, as well as varying quantities of larger sizes up to and including 2-inch.

Depending on your requirements you may select any of four combinations of BADGER METER TESTERS . . . 1 — With BOTH large and small Visible Flow Indicators* and BOTH 10-gal. and 100-gal. calibrated tanks**; 2 — With large indicator only; 3 — With small indicator only; 4 — Without either indicator. (Note: *The LARGE Visible Flow Indicator accurately indicates flow from 5 to 160 gallons per minute; the SMALL Indicator, 1/16-gallon to 10 gallons per minute. These Visible Flow Indicators are *positive*, not merely *proportional*, in their indications. **The Calibrated Tanks are fully assembled with gauge glass, plumb bob, graduated scale and bronze drain valve. On each side of the gauge glass are mounted brass angle strips, enameled white, with graduation marks in high visibility black . . . in U. S. Gallons, Imperial Gallons, Cubic Feet, Litres, or any other units of measure desired. The tanks are heavy gauge steel with all joints welded).

Ruggedly built, BADGER METER TESTERS are long-lived and dependable. The Test Pan and legs are reinforced, welded, structural steel, light in weight and unbreakable. The Test Bench Pan, 5" deep, has its upper edge turned inward to prevent water from splashing over the edge while draining meters after testing. This in-turned edge also locks the supports in place when the tail stock is tightened . . . NO BUCKLING. The interchangeable meter supports are furnished with petcocks to release all air and set the meter test hands to zero before testing.



Close-up view of tail stock, quill and flow-indicators.



Eight-station Meter Tester

Spacer pipes are furnished for fill-in whenever it is necessary to test fewer than the total meter-capacity of the tester.

The tail stock quill, when moved, rides on supports on the test bench bed, so the load is carried on the quill supports rather than on the quill itself.

In every detail BADGER METER TESTERS are soundly engineered to serve you long and accurately. Write for further information and prices.

BADGER METER MFG. CO., Milwaukee 10, Wis.

Branch Offices: New York City • Philadelphia • Worcester, Mass. • Savannah, Ga. • Cincinnati • Chicago • Kansas City
Waco, Texas • Salt Lake City, Utah • Guthrie, Okla. • Seattle, Wash. • Los Angeles

BADGER *Water* METERS

"MEASURING THE WATER OF THE WORLD"

First FOR ACCURACY • LOW-COST MAINTENANCE • DURABILITY • SENSITIVITY

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING!

Centrifugal Pumps and Their Operation

Nothing in water works operation counts for as much dollar-wise as does pumping. A "misfit" centrifugal pump, or other causes for poor efficiency in pump performance, can be the greatest waster of water utility dollars of any single operation. Naturally, of first importance is that of selecting the correct pump for the conditions under which it is to be installed and operated. After that, if the aim is to keep as many dollars as possible in the water utility and not paid out as power costs, one can never know too much about the methods of checking pump performance and the maintenance of pumping efficiency. We are, therefore, pleased to announce the early beginning of a series of articles on "Basic Factors in Centrifugal Pump Application," and related considerations in centrifugal pumping of water and sewage by—

ROY CARTER and I. J. KARASSIK,
Application Engineers, Worthington Pumps.

A Complete Sewer System of Asbestos-Cement Pipe

As far as we know Macclenny, Fla., is the first to have a sewer system constructed wholly of asbestos-cement pipe, including house connections also. This article, based on experience, observed facts and results, presents the several advantages predicted and realized in the construction of sewers with the long length asbestos-cement pipes laid with semi-flexible bottle-tight joints.

A. E. WILLIAMSON and JOE WILLIAMSON,
Russell and Axton, Engrs., Daytona Beach, Fla.

Water Treatment Experiences

A well qualified chemist and superintendent of water treatment with varied experience and keen observation sets forth some of his "Experiences in Water Treatment" in a series of articles, designed to be helpful to the less experienced and interesting to all. The author of this new series, which began in our January issue, is—

ALBERT H. ULLRICH, Supt.,
Water & Sewage Treatment, Austin, Tex.

Sewage Treatment Equipment

Is the subject of a valuable series of articles, now running, on the design, installaion, operation and maintenance of equipment in sewage treatment plants. Each article is to deal with some unit operation of modern sewage plants, and will present information of value to designers, operators, and also manufacturers of such equipment. Articles to follow cover "Sludge Digesters"; "Vacuum Filtration of Sludge"; "Drying and Incineration"; "Trickling Filter Distributors"; "Aeration Equipment"; "Gas Storage and Utilization," and others. The author is—

FRANK L. FLOOD,
Metcalf & Eddy Engrs., Boston, Mass.

Operation of Small Water Plants

Is a continuing series of articles by the same author of the popular series on the "Operation of Small Filter Plants" published previously. The next two articles of the series will deal with "Organization and Management" and "What About the Manager?" as the provocative title of the final article of the series. The author is—

A. E. CLARK, Gen'l. Mg'r.,
Nashville (Tenn.) Suburban Utility Distr.

Settling Tank Design

Is discussed by Prof. F. Popel of Stuttgart, Germany, in an illuminating article which appeared in "Gesundheits Ingenieur." We have asked C. E. Keeper, Deputy Sewerage Engr. of Baltimore, to prepare a translation of this important article for publication in an early issue. To this Prof. Popel is adding more recent disclosures than those appearing in the original article, plus a useful design nomograph.

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Water & Sewage Works is indexed regularly by Engineering Index, Inc.

Publication Office, 404 N. Wesley Ave., Mt. Morris, Ill.
(Address communications to the Executive Office or the Editorial Office)

EXECUTIVE OFFICE: 22 W. Maple St., Chicago 10, Ill.
EDITORIAL OFFICE: 155 E. 44th St., New York 17, N. Y.

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WATER AND SEWAGE WORKS is a monthly publication. Single Copies, 25c; Subscription Rates, U. S. and Canada, $2 per year; Foreign, $3.

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CLEAN WATERS *at*

Airview of the Bird Island Sewage Treatment Works at Buffalo, N. Y. Treatment includes pumping, screening, aeration, chlorination, sedimentation, sludge digestion and incineration.

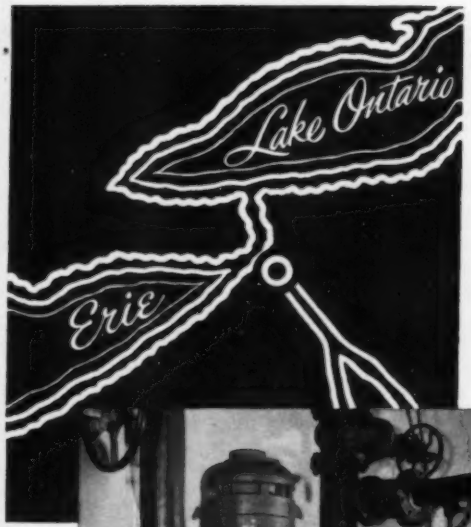
A G-E 7½-hp induction motor drives a sludge mixer. With their extra protection against physical damage, electrical breakdown and operating wear and tear, G-E motors assure long life and high service continuity.

Three G-E 7½-hp splashproof induction motors drive filtrate pumps for vacuum filters. These motors have already given 12 years of service although constantly subjected to moisture from dripping and splashing.

GENERAL ELECTRIC

Buffalo HELP KEEP A TREATY

G-E Equipped Treatment Plant Guards International Waters



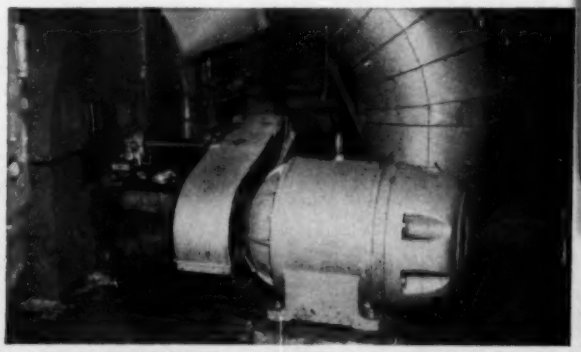
Since its dedication in 1938, Buffalo's sewage treatment plant has helped make good a U.S.—Canadian Treaty signed over 40 years ago to protect international waters from pollution. Located on Bird Island in the Niagara River, the plant has helped keep waters clean from Buffalo to Lake Ontario.

Plant officials attribute much of the success of the Buffalo plant's operation to the outstanding service given by some 100 General Electric motors. In many cases operating under the most severe conditions, the motors have given continuous and reliable performance.

General Electric can help your community get that new or improved sewage treatment plant by (1) assisting you and your consultant in formulating electrical plans, and (2) building public support through the use of G.E.'s full-color sound movie, *Clean Waters*.

Contact your General Electric representative early in the planning stage. *Apparatus Dept., General Electric Company, Schenectady, N. Y.*

Sludge circulating pumps for the digester tank are driven by G-E 10-hp vertical drip-proof motors. G-E vertical motors now have improved bearing lubrication and double-end ventilation for longer life and more efficient operation.



This is one of the G-E 50-hp, totally enclosed, fan-cooled induction motors used to drive exhaust fans for the sludge incinerator. The corrosive atmospheres in buildings like this call for motors that can take it.

GE SEWAGE-PLANT

SEWAGE PLANTS PREFER climax power

Yes! Just a few of the many installations in municipally owned sewage treatment plants.

Litchfield, Illinois
Aurora, Illinois
Wichita, Kansas
Michigan City, Indiana
Borough of State College, Pennsylvania
Davenport, Iowa
Pueblo, Colorado
Chicago Heights, Illinois
Wooster, Ohio
Lake Charles, Louisiana
Cedar Rapids, Iowa
Iowa Great Lakes Division System, Okoboji, Milford, Iowa
Ithaca, New York
Kenosha, Wisconsin
Rock Island, Illinois
Wausau, Wisconsin
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Sewage Plants:

Records from these plants prove that Climax sewage gas engines produce power at a cost of less than $.0015 per horsepower hour. Sizes 40 to 225 HP.

For complete information and service records of Climax Engines for Water and Sewage Works write to Climax Engine and Pump Mfg. Co., 308 S. La-Salle Street, Chicago, Illinois.

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Factory and General Office
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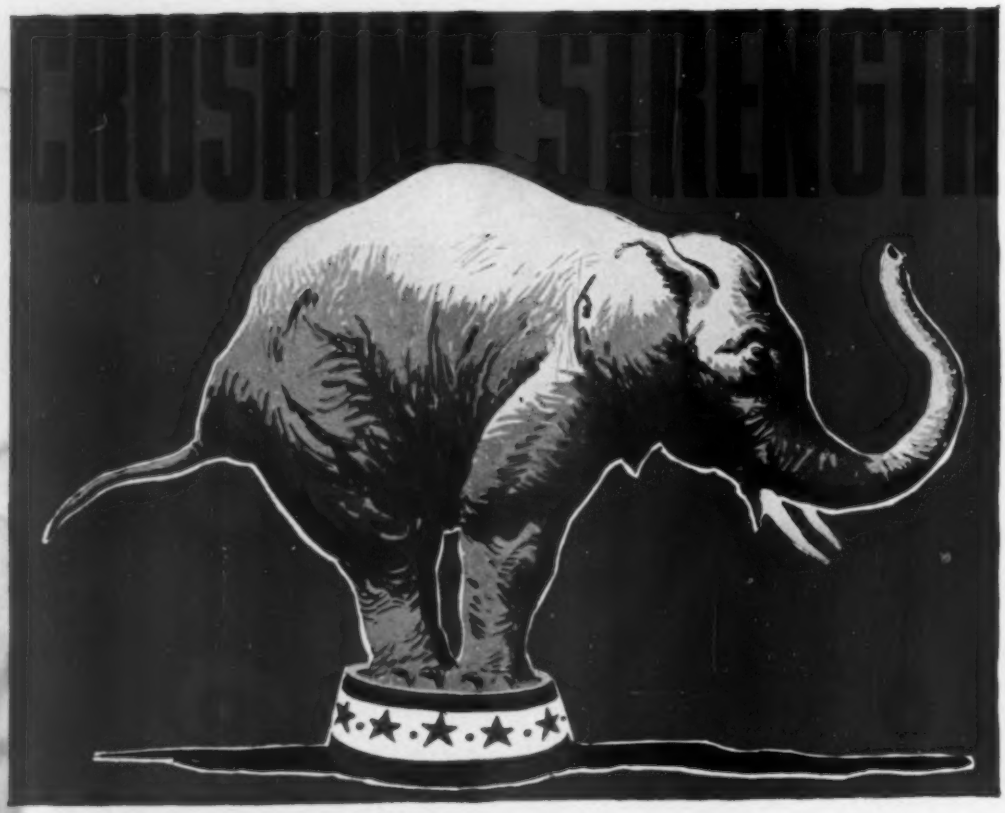
There's a solid satisfaction in specifying cast iron pipe. You know that your choice coincides with the judgment of leaders of your profession the world over. And when the line is backfilled, you are confident that it will serve throughout a long life at a low annual maintenance cost. This has been true of cast iron pipe for centuries; yet in the fifty-one years since our Company was founded, notable advances in manufacturing methods and controls have been made, resulting in a finer, more uniform pipe. United States Pipe and Foundry Company, General Offices: Burlington, N. J. Plants and Sales Offices Throughout U. S. A.

U.S.
cast iron
PIPE



Without crushing strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in *city streets* would be in service today.

But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada.

Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.

CAST IRON PIPE

Strength factors of Long Life !

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

SERVES FOR CENTURIES

It's up to 25 times more "Non-Clog"!

Here . . . now . . . is an amazing development in sewage and trash pumps . . . the Fairbanks-Morse *Bladeless* Impeller Pump.

In actual tests and field operation, it is from 10 to 25 times more "non-clog" than any conventional sewage and trash pump. It gives you improved efficiency in pumping water containing solids and trashy materials. It gives you a new conception of low maintenance cost. This pump rarely has to be dismantled to clear "clogged" impellers. Contrast this to the ordinary pump where dismantling is required as much as several times daily.

Another important advantage is the fact that for a specific solids size, the pump delivers approximately one-half the capacity of conventional sewage pumps. Thus you do not flood filter beds in plants where sewage flows are relatively low. Reduced capacity permits the use of smaller driving motors, thus assuring economical initial costs . . . lower power costs.

For complete details, check your Fairbanks-Morse Pump Distributor, local branch office, or write Fairbanks, Morse & Co., Chicago 5, Ill.

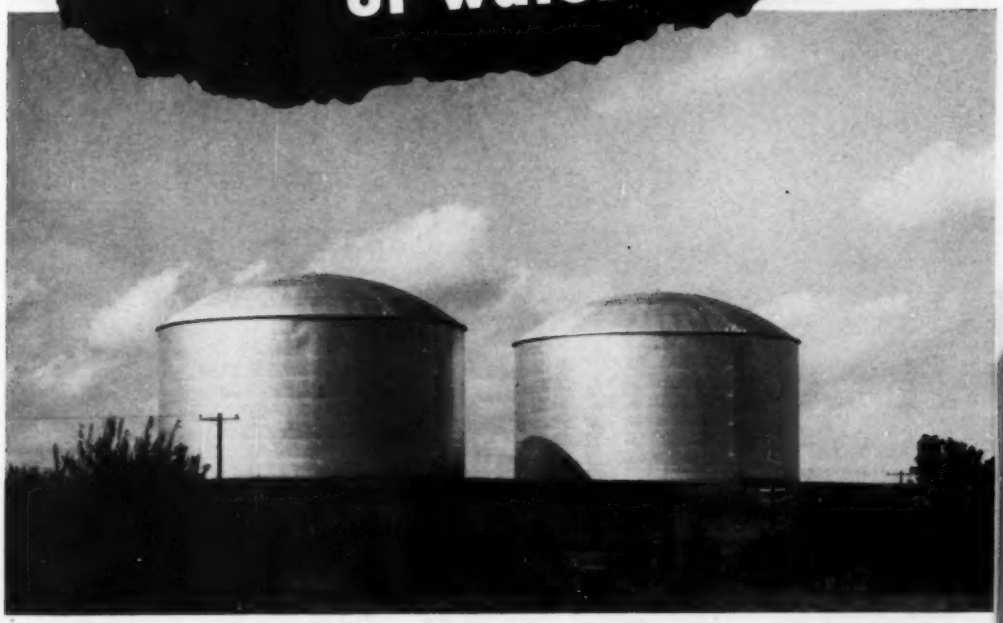
Eliminating blades, this impeller is a helical channel . . . a "whirling tube" with no blades to catch and hold fibrous trash and cause the pump to clog.

FAIRBANKS-MORSE,

a name worth remembering

Diesel Locomotives and Engines • Electrical Machinery • Pumps • Scales
Home Water Service and Heating Equipment • Rail Cars • Farm Machinery

10,000,000 Gallons of water



in twin Horton Reservoirs at Oklahoma City

Like a growing boy needs food, a growing city needs water—and lots of it. The twin Horton welded steel reservoirs shown above help make sure that Oklahoma City, Oklahoma, won't go "water hungry" if its growth continues. They have a capacity of 5,000,000 gallons each and are part of a waterworks system that serves 53,000 customers through 435 miles of distribution mains.

Many other municipalities are finding that steel reservoirs like this frequently make it possible to increase the effective capacity of a system at a fraction of the cost of expanding the entire distribution system. Welded tanks are easy to construct and maintenance costs are low. The welded joints are *made* water tight and *stay* that way. Steel will not crack and leak if there is uneven settlement.

Horton welded steel reservoirs are built in capacities up to 10,000,000 gallons. When you plan improvements in water storage facilities, write our nearest office for information and quotations.

Other Horton Water Tanks

- **Horton Ellipsoidal-Bottom Elevated Tanks** . . . supply gravity water pressure. Built in standard capacities from 15,000 to 500,000 gallons. Widely used by smaller communities and for distributed elevated storage in a large water service system.
- **Horton Radial-Cone Bottom Elevated Tanks** . . . available in capacities from 500,000 to 3,000,000 gallons. Utilizes a design which makes it possible to build large capacity tanks with relatively low ranges in head.
- **Horton Watersphere** . . . newest addition to the Horton line of elevated tanks. Available in capacities from 25,000 to 250,000 gals., any desired height to bottom.

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Philadelphia 3 ..... 1644—1700 Walnut Street Building
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San Francisco 4 ..... 1583—200 Bush Street
Seattle 1 ..... 1350 Henry Building
Tulsa 3 ..... 1646 Hunt Building

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

In Canada—Horton Steel Works, Limited, Fort Erie, Ont.

Lower Excavation Costs

Substantial savings in excavation costs are often possible with Transite* Sewer Pipe because of its high flow capacity. This often permits the use of flatter grades and shallower trenches. This is a particularly important advantage where the pipe must be laid at or below the ground water line or where rock excavation is involved.

As an alternate economy, designers may take advantage of Transite's high flow capacity by specifying smaller diameter pipe.

Other Transite Economies

Transite's long 13-foot lengths and light weight lower handling costs. And because there are fewer joints to assemble in the finished line, installation is faster, and more economical.

As a further economy, Transite's sleeve-type joints guard effectively against infiltration. This helps reduce the load on the treatment plant. Therefore, treatment costs are kept to a minimum—plant capacity is conserved for the increased loads incident to community growth.

Made of asbestos, cement and silica combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant both inside and outside. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low maintenance costs through the years.

For all the facts about Transite, send for brochure TR-21A. Address Johns-Manville, Box 290, New York 16, N. Y.

JM

*Transite is a Johns-Manville registered trade mark

.....Johns-Manville

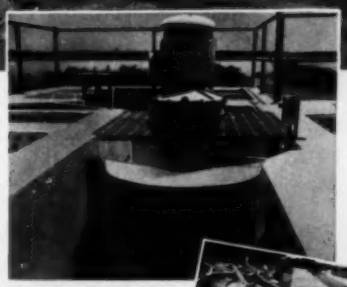
TRANSITE SEWER PIPE...

FOR EVERY STEP OF YOUR SEWAGE TREATMENT PROCESS

WHEN you specify INFILCO Sewage Treatment Equipment, you get more than just equipment. Actually, you specify over 50 years experience in the design and manufacture of a *complete range* of water, sewage and waste treatment equipment.

You have *one source* to depend upon for experience in both chemical and biological treatment . . for the major equipment items as well as the important control devices. And by providing a *complete range* of sewage treatment equipment INFILCO offers the all-important advantage of *undivided responsibility!*

A complete laboratory and staff of competent engineers are available for making recommendations and reports to the consulting engineer or his client. It is, of course, intended that this service shall cooperate with the work of your engineers. When considering your next sewage treatment plant, or the modernization of an existing one, consult your Telephone Red Book. Call in your nearest INFILCO Field Engineer!



SEND FOR . .

Bulletin No. 60-C. It illustrates and describes many items of Infilco Equipment.

INFILCO

BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894

INFILCO INC.

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

CLAY PIPE PROTECTS 'decision buyers'

WHERE products are "decision-bought" — by engineers, consultants, or men in public life — professional reputations are constantly at stake. The choice of Vitrified Clay Pipe protects those reputations, because Clay Pipe *never wears out.* It can be specified with safety on *every* sewerage or drainage job . . . for present or future wastes, for the soil conditions of tomorrow or fifty years from now. "Bad guesses" are impossible with Vitrified Clay Pipe. You can disregard sulphide controls and the effects of sewage temperature, velocities, and age of sewage, because Clay is immune to chemical action. It's the only pipe that's *sure* to protect *your* decisions . . . by lasting forever!

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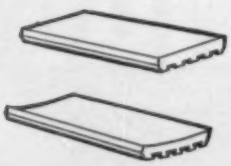
SPECIFY

Vitrified
CLAY PIPE
CLAY PIPE NEVER WEARS OUT!



LINER PLATES

STANDARD-STRENGTH CLAY PIPE

CLAY PIPE FITTINGS

C-458-1

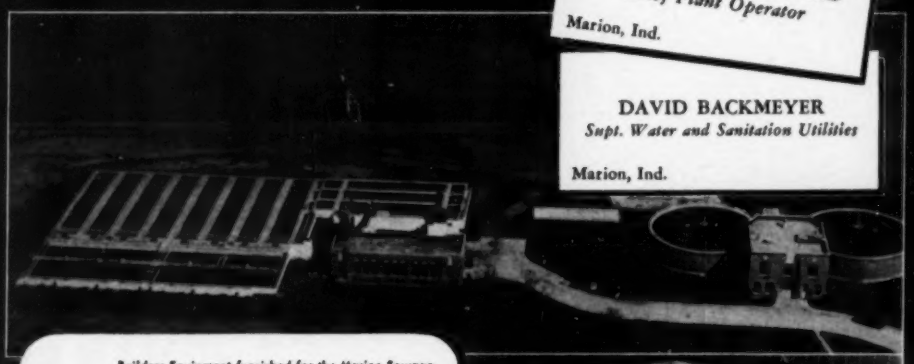
MARION, INDIANA

Sewage Treatment Plant

CONSOER, TOWNSEND AND ASSOCIATES
Consulting Engineers
Chicago, Ill.

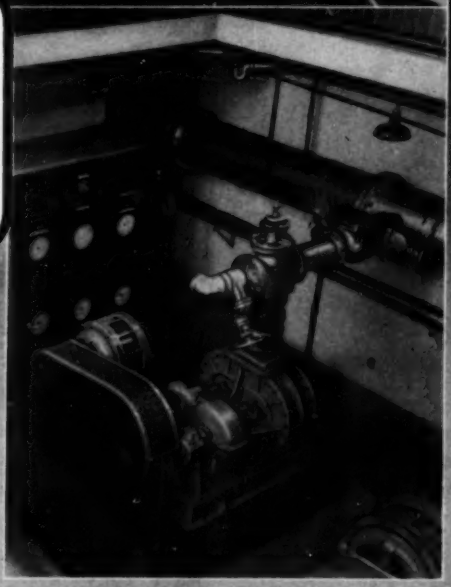
RAYMOND STRICKLAND
Chief Plant Operator
Marion, Ind.

DAVID BACKMEYER
Supt. Water and Sanitation Utilities
Marion, Ind.



Builders Equipment furnished for the Marion Sewage Treatment Plant:

24" Venturi Tube with Flo-Watch Totalizer-Indicator-Recorder for raw sewage.
6" Venturi Tube with Flo-Watch Totalizer-Recorder for raw sludge.
12" Venturi Tube with Flo-Watch Totalizer-Indicator-Recorder for return sludge.
12" Venturi Tubes with Manometers for mixed liquor.
8" Venturi Tubes with Manometers for air.



A population of approximately 30,000 plus manufacturing and food packing plants contribute to the major disposal problem which must be handled by the Marion Sewage Treatment Plant. Year in and year out, flows vary from 3 to 8 MGD, the average treatment load being about 5½ MGD.

To cope with the fluctuating flow rates, and to obtain the utmost purification, the Marion Plant employs the activated sludge treatment process. Complete records of every phase of the process provide the essential data for day-to-day operation and long-range planning. Builders Venturi Meters supply this vital information, metering the flows of raw sewage, raw sludge, return sludge, mixed liquor, and air. For Bulletins describing Builders Sewage Works Equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.

BUILDERS PROVIDENCE
Instruments

"Signposts" of Progress

in BETTER WATER STORAGE

Elevated Steel Tanks

by

PITTSBURGH • DES MOINES

Dependable water service for the progressive community is marked with distinction by P-DM Elevated Steel Tanks. Handsome in appearance, efficient in performance, economical to use and maintain, Pittsburgh-Des Moines Tanks are always a sound investment. *Write for our latest Water Storage Brochure.*

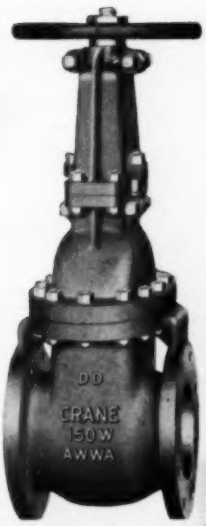
PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle St.
NEW YORK (7)	Room 918, 270 Broadway	DALLAS (1)	1223 Praetorian Bldg.
CHICAGO (3)	1222 First National Bank Bldg.	SEATTLE	926 Lane Street
	SANTA CLARA, CAL.	625 Alviso Road	

Piping for every water service From one Source . . . CRANE



No. 2495, Outside screw and yoke. Cold Water Working Pressures: 12-inch and smaller, 200 pounds. 14-inch and larger, 150 pounds. Sizes: 2 to 24-inch.

FOR TIGHT SEATING . . . EASY OPENING

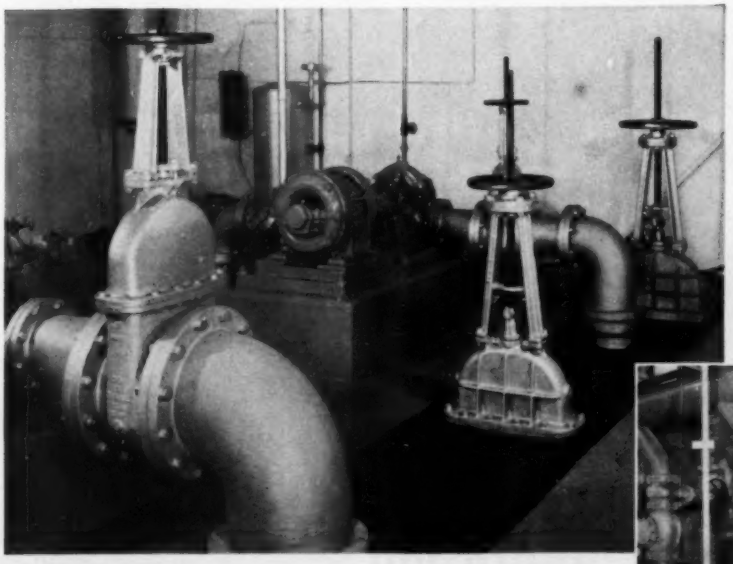
Crane A.W.W.A. Iron Body Gate Valves cannot be surpassed. Crane parallel seat and double disc construction assures pressure-tight closure . . . easy opening . . . under all operating conditions. To prevent corrosion, screwed-in body seat rings are brass; discs are brass or brass faced.

Crane design assures maximum strength for all recommended services. Body and bonnet are oval shaped, with uniformly thick metal sections; tie ribs between bonnet flange and end flanges assure proper body support and guard against line strains.

Straight-through ports give uninterrupted flow. Two-piece gland maintains uniform pressure on packing; prevents binding on stem; lengthens packing life. These valves can be motor or cylinder operated; equipped with gears and by-pass. Flanged and hub ends available. See your No. 49 Crane Catalog.

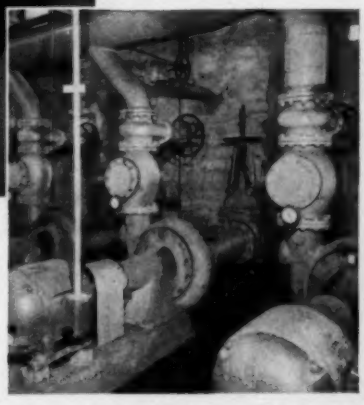
CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE ORDER TO CRANE COVERS ALL MATERIALS FOR YOUR PIPING INSTALLATIONS



RAW WATER INLET *lines to high service pumps, featuring Crane low pressure iron body double disc gate valves.*

PUMP HOUSE *for moving industrial waste water to treating plant. Crane equipment includes shop fabricated manifold, iron body gate and check valves.*



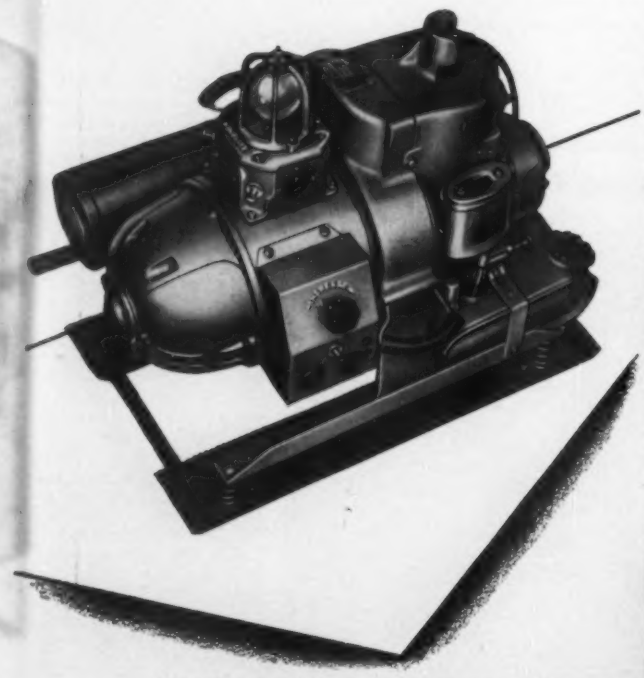
EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

From Every Angle

A Homelite Carryable Generator Is the Power Unit for You...

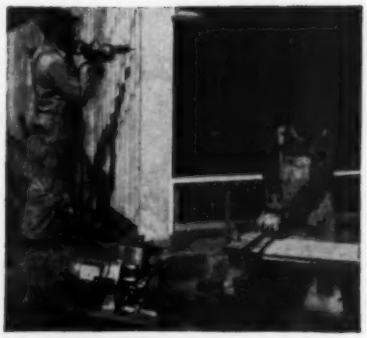


STICK TO THE RULE OF THREE 1. Performance 2. Dependability 3. Service, and you'll always stick to a Homelite.

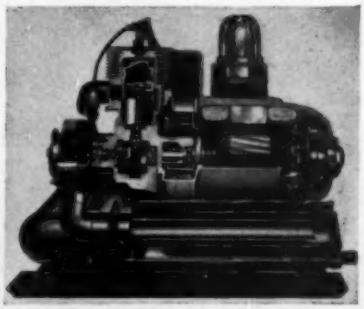
PERFORMANCE DEPENDABILITY SERVICE

Homelite Corporation

708 RIVERDALE AVENUE, PORT CHESTER, NEW YORK



1. PERFORMANCE. Once you begin to use a Homelite . . . yes, even when you see it demonstrated . . . you immediately appreciate its outstanding performance. Light enough for one man to carry, a Homelite packs the power needed to keep hand tools running at full productive capacity . . . and floodlights burning at full brightness . . . at any time at any place in all kinds of weather.



2. DEPENDABILITY. Every Homelite Generator though light in weight is a *heavy duty* unit. No baby stuff about it. For more than a quarter century Homelite engineers have specialized in building carryable gasoline engine units . . . close to three hundred thousand of them . . . and they know that to keep a generator going on the job they have to use the finest materials and apply the highest engineering skill.

3. SERVICE. Like all pieces of machinery, a Homelite Generator needs, in the long run, a certain amount of servicing . . . a minimum to be sure. But the availability of Homelite service by nationwide exclusive service shops . . . completely stocked and manned by experts who can service your Homelite *right at your door* . . . makes a whale of a difference when it comes to having a generator that will give you instant power not only where you want it, but also when you want it.

you'll find IOWA VALVES installed in water treatment plants everywhere

Gate valves	Relief valves
Check valves	Floor stands
Sluice gates	Floor boxes
Shear gates	Valve boxes
Mud valves	Hydraulic and motor
Flap valves	operated valves

IOWA'S complete line of valves is specially designed for severe operating conditions in filter plant service.

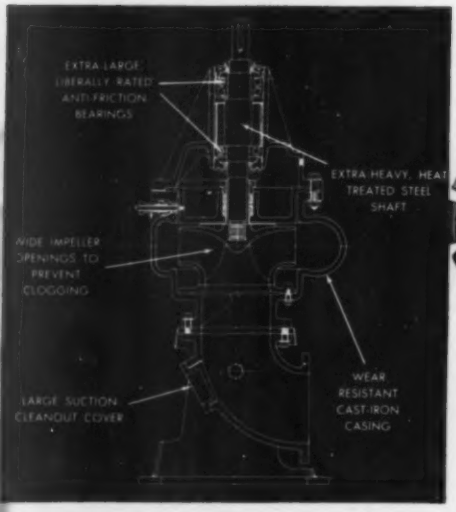
Specify IOWA VALVES and let us solve your problems on water flow control.

IOWA VALVE COMPANY

201-299 N. Talman Ave., Chicago 80, Ill. • *A Subsidiary of James B. Clow & Sons*

A BRUTE for Punishment!

ALLIS-CHALMERS
Sewage Pump


EXTRA-LARGE LIBERALLY RATED ANTI-FRICTION BEARINGS
EXTRA-HEAVY, HEAT TREATED STEEL SHAFT
WIDE IMPELLER OPENINGS TO PREVENT CLOGGING
LARGE SUCTION CLEANOUT COVER
WEAR RESISTANT CAST-IRON CASING

GENEROUSLY DESIGNED AND HEAVILY CONSTRUCTED TO GIVE YOU LONG-LIFE OPERATION AND LOW MAINTENANCE

FROM SHAFT TO BASE, extra-heavy construction in this new sewage pump adds up to long wear and low maintenance.

The shaft is heavier than in conventional sewage pumps—and made of open-hearth, heat-treated steel selected for high shock strength to resist breakage. Anti-friction bearings are extra-large and liberally rated. Impeller inlets are rounded-off, generously large to prevent clogging.

A radially-split casing makes it easy to remove the complete rotating element by simply removing the universal coupling and loosening a few bolts. You do it all in a few minutes and don't have to disturb the intake or discharge piping.

Standard sizes to 10,000 gpm — can be built larger. See your nearest A-C Sales Office or write for Bulletin 08B7504 for more complete details on this new pump. A-3113

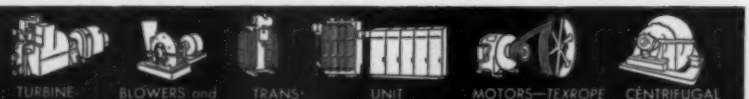
ALLIS-CHALMERS, 1192A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

A-C

Texrope is an Allis-Chalmers trademark.

World's Widest Range of Public Works Equipment



Here's FAST unfailing operation

at every touch of the control

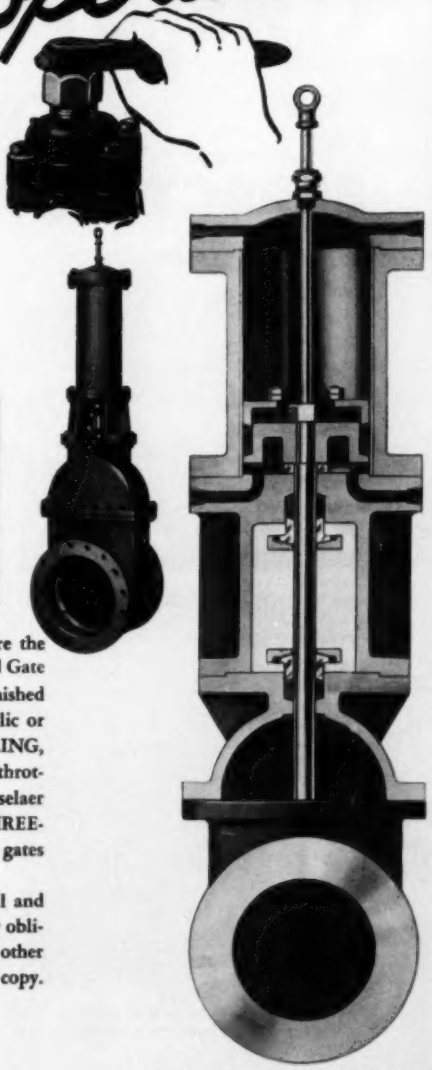
RENSSELAER

Cylinder Operated

GATE VALVES

SERVICE APPLICATIONS

1. *Automatic control.*
2. *Fast operation.*
3. *Frequent operation.*
4. *Filter plants.*
5. *Pumping plants.*
6. *Remote control.*



WHERE operation must be fast and positive, no matter where the location, you can depend upon Rensselaer Cylinder-operated Gate Valves. Their construction is rugged and simple. They are furnished for valves of all sizes and working pressures, for either hydraulic or pneumatic operation. Where the valve is to be used for THROTTLING, adjustable stops may be supplied for adjusting piston travel. For throttling service or frequent operation service we recommend Rensselaer Square Bottom Gate Valves. These are the valves with the THREE-POINT support of the gates, which eliminates any tendency of gates to tilt, bind or score seat faces when partly open.

Upon request, a Rensselaer representative will be glad to call and discuss your problems of Valves and Valve operation, without any obligation on your part. Complete details of the above valves and other Rensselaer products are given in newest Catalog H. Send for your copy.

LEADERSHIP FOR OVER 65 YEARS

RENSSELAER

VALVE COMPANY

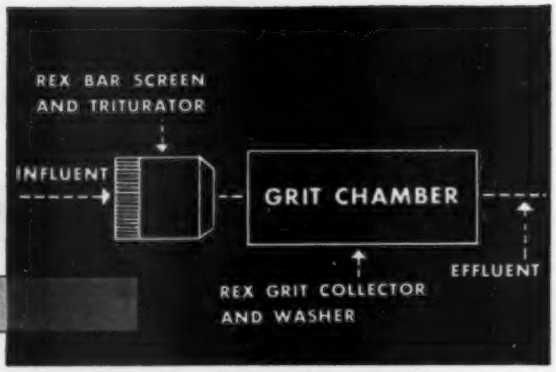
Hydrants • Gate Valves • Square Bottom Valves
Check Valves • Tapping Sleeves and Valves • Air Release Valves

TROY, NEW YORK

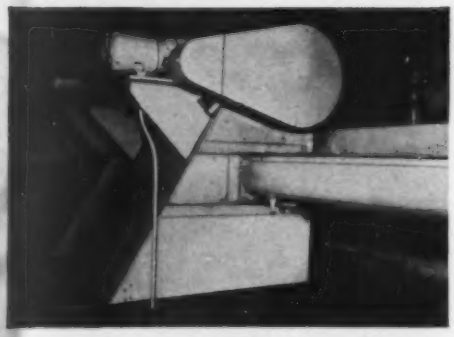
Division of Neptune Meter Company

Atlanta, Bala-Cynwyd, Pa., Chicago, Dallas, Denver, Haverhill, Mass., Hornell, N. Y. Kansas City, Los Angeles, Memphis, Oklahoma City, Pittsburgh, San Francisco, Seattle

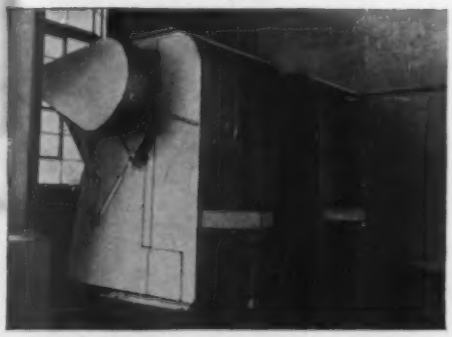
Sectional View of Cylinder-Operated Valve with Iron Brass-lined Hydraulic Cylinder and Tucks Packing type pistons. Cylinders also available in Skeleton Brass type construction, and with Cup Leather Packing.



LINE-UP for EFFECTIVE SEPARATION



Rex V-Bucket Type Grit Collectors employing the Rex Recirculation Process for effective grit control at Boat Harbor Plant.



Rex Type MA Mechanically Cleaned Bar Screens equipped with Rex Triturators at Boat Harbor Plant.

For most effective separation and removal of inorganic solids from liquids, rely on Rex Mechanically Cleaned Bar Screens and Rex Grit Collectors.

At the Boat Harbor Sewage Treatment Plant in Newport News, for example, these efficient units are more than meeting the requirements. Two Rex type "MA" Bar Screens in channels 3′ wide x 15′ 6″ deep effectively remove large solids. The Rex Features . . . large bar rack area exposed to flow; straight, unobstructed flow; low head loss; large reserve capacity; rugged design; low installation and operating costs . . . assure maximum efficiency.

Material removed by the bar screens is ground to small size by Rex Triturators . . . the only screenings grinder that positively cuts material to bits by the shearing action of 2,000,000 blade cuts per minute. Ground material is returned to the liquid flow immediately behind the screen.

Two Rex V-Bucket Type Grit Collectors effectively separate and remove inorganic grit from the flow. Buckets carry and elevate the grit to a hopper which in turn feeds the grit into a cross screw conveyor. Conveyor discharges the grit into buckets for disposal. An important advantage of Rex Grit Collectors is their built-in recirculation process which provides effective control of grit quality. All grit is returned to the top of the incoming average or normal flow at the channel entrance. Organic material is thus carried out of the channel for further treatment . . . only concentrated grit resettles for disposal. No organic material can settle at the outlet end during periods of low flow.

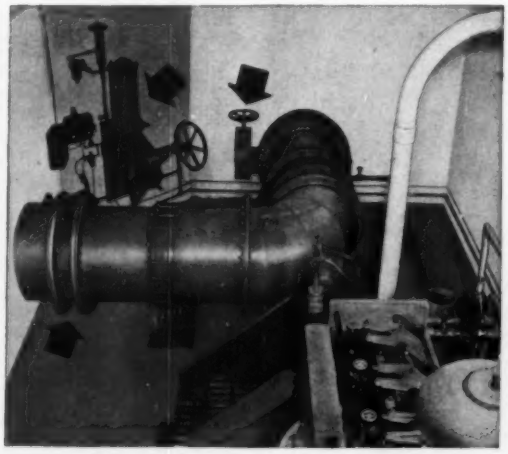
Why not obtain these effective advantages for your plants? For all the facts, send for your copy of Bulletin No. 48-41. Chain Belt Company, 1610 W. Bruce Street, Milwaukee 4, Wisconsin.

CHAIN BELT REX COMPANY

SANITATION EQUIPMENT

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



TULSA WATER SUPPLY
Increased in Record Time

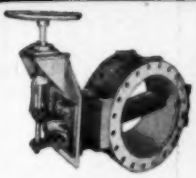
The City of Tulsa Water Department increased its water supply from twenty-four to minimum requirements of thirty-five million gallons a day without constructing a second gravity flow line. This was accomplished by means of booster stations at strategic points.

The fifteen R-S Valves supplied for this emergency operation ranged in size from 36-inch handwheel operated to 60-inch air cylinder operated with handwheel declutching units. After delivery, these valves were slipped into the line in a matter of hours. The entire project was completed in remarkably fast time.

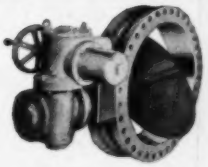
Due to an improvement in vane design, the flow rate in R-S Heavy Duty Valves (12-inch and larger) has been increased approximately 25% in the wide open (77½°) position. In case after case, the saving in pumping (or blower) costs will pay for an R-S Valve in short order based on "K" values alone.

Consult with your local R-S Valve Engineers. Look for the address and phone number listed under "R-S Products, Valves" or write direct.

R-S PRODUCTS CORPORATION
Wayne Junction • Philadelphia 44, Pa.

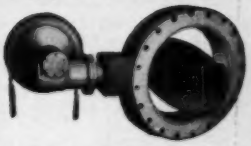


No. 700—20-inch 50-pound Cast Iron Valve with rubber seat, Type B-8934, for positive 100% shut-off. Heavy duty handwheel control with threaded reach rod. Type B-9469.



No. 724—42-inch 50-pound Heavy Service Valve, B-9813, complete with limitorque motor and gear reduction drive No. 4. Angular seating vane for wedge-type closure with metal seat. Rubber seat available if desired. Valve body good for 125 psi gauge static head and drip tight shut-off at 50 psi pressure drop with rubber seat.

No. 768—66-inch Fabricated Steel Handwheel Operated Valve with ends scrafted for welding. 6½-inch diameter one piece Stainless Steel shaft mounted on thrust bearings (valve installed with shaft vertical). Horizontal and vertical ribs on body prevent distortion when machining and assembling. Stuffing box easily repacked. Used to control river flow during dam construction. Open atmospheric discharge.



No. 737—30-inch 50-pound Heavy Service Valve (B9804) with rubber seat (B8934). Gear reduction drive No. 3 with chainwheel.

Performance

THAT SUMS UP TO Satisfaction WITH P.F.T. EQUIPMENT ON THE JOB!

CITY OF WINCHESTER VIRGINIA

EXECUTIVE OFFICES

S. L. GRANT
City Manager

December 31, 1949

Pacific Flush-Tank Co.
441 Lexington Avenue
New York 17, New York

Mr. L. L. Langford

Gentlemen:

We thought that you would like a report on our progress.

As you remember, we started primary digestor operation 13 December. On 21 December we were producing over 15,000 cu. ft. of combustible gas a day. Due to various difficulties caused by construction delays, no attempt was made to switch the pre-heater from butane to sewage gas. On 30 December we felt that all construction difficulties had been over come, and the switch was made. The pre-heater burned the gas beautifully, and is maintaining a better temperature than with the bottled gas. You might be interested to know that the bottled gas left a considerable carbon deposit in the combustion chamber, but as soon as we switched to digestor gas the carbon was burned, and now the chamber is perfectly clean.

We have transferred only enough supernatant from the primary to the secondary digestor to float the secondary cover, and have not yet filled the primary digestor. We have the temperature of the primary up to 85°, and intend to get it to 90° before we start bringing up the temperature in the secondary. The pH is up from 6.0 to 6.5, so we are not too concerned about this.

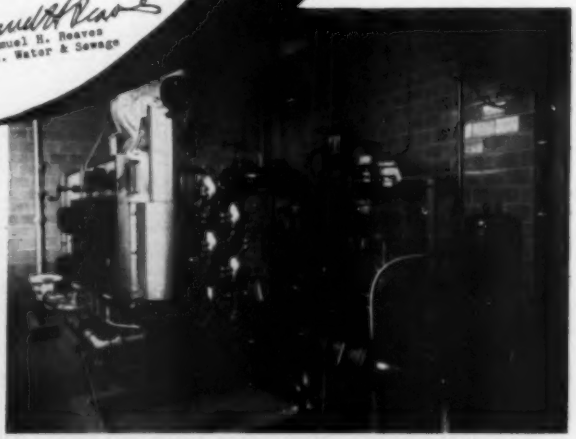
We feel that the pre-heater is operating beautifully, and justifies our efforts to have it installed.

With best wishes for the New Year, we are

Very truly yours,

Samuel H. Reaves
Supt. Water & Sewage

bh



The LETTER ABOVE IS MORE ELOQUENT

than anything we could say about the P.F.T. Digester Heater and Gas Safety Equipment installed at Winchester, Va., to serve two P.F.T. 43 ft. Floating Cover Digesters. Sewage plant officials and consulting engineers who have had experience with P.F.T. Digester Heaters and Heat Exchangers, and auxiliary gas control equipment insuring positively safe operation, are unanimous in their praise.

P.F.T.

PACIFIC FLUSH TANK CO.

SEWAGE TREATMENT EQUIPMENT EXCLUSIVELY SINCE 1893

4241 RAVENSWOOD AVENUE CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • DENVER • TORONTO

Will Sodium Fluoride help preserve this smile?

THANKS TO dental research on ways of reducing tooth decay, more and more of our children will grow up with sound, strong teeth. For example, one phase of present-day research is indicating that Sodium Fluoride may become an important weapon for combating tooth decay.

FOR SEVERAL YEARS, a number of communities have been adding Sodium Fluoride to municipal water supplies low in natural fluorine content. Preliminary reports indicate a 25 to 30% lower rate of tooth decay among children drinking these treated waters.

FROM SUCH STUDIES, dental, municipal, and public health authorities will shape plans for the future—possibly extend these preventive measures to scores of other cities and towns the nation over.

• • •

From municipalities using its Sodium Fluoride, General Chemical has gained considerable knowledge of the mechanical aspects of water fluoridation. Its Technical Service is available to officials considering similar programs. For additional information, consult the nearest General Chemical office listed below.

Water Fluoridation

Regular Dental Care

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit • Houston Jacksonville • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh Providence • San Francisco • Seattle • St. Louis • Wenatchee and Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

BASIC CHEMICALS
GC
FOR AMERICAN INDUSTRY

NEW!

—just off the press—a bulletin on Layne Short Coupled Service Pumps, showing many diagrams of application for circulating and process pumping, lake and river intakes, drainage, line boosters and de-watering uses. Write for your copy today.

LAYNE OFFERS ALL OF THIS-

• Layne—and Layne alone is in a position to offer nearly three quarters of a century of world-wide experience in the designing and building of municipal, industrial and irrigation Well Water Systems.

• Layne—and Layne alone can offer all services from the original exploration to the designing of the systems, drilling the wells, building and installing the pumps,—and final delivery with a dependable guarantee of performance.

• And again it is Layne and Layne alone who can offer the services of eleven strategically located Associated Companies, each of which is widely experienced and fully capable of,—and has made installations of all sizes.

• It is Layne—and Layne alone who can offer evidence of their skill and success by pointing to thousands of installations made throughout the United States, Canada, Mexico and Latin America, Europe, Africa and Asia.

• Such experience and skill adds up to a splendid recommendation for all who are contemplating the installation of a Well Water System. For catalogs, bulletins, etc., address

LAYNE & BOWLER, INC.
GENERAL OFFICES, MEMPHIS 5, TENN.

LAYNE ASSOCIATED COMPANIES

ASSOCIATED COMPANIES—Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ The Layne-Texas Co., Ltd., Houston, Tex. ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Minnesota Co., Minneapolis, Minn. ★ International Water Corp., Pittsburgh, Pa. ★ International Water Supply, Ltd., London, Ont. ★ Layne-Hispano Americana, S.A., Mexico, D. F. ★ General Filter Company, Ames, Iowa.

LAYNE
WELL WATER SYSTEMS
VERTICAL *Turbine* PUMPS

MARTINSVILLE, VA.

Water Works

(COMPLETED IN 1948)

WILEY and WILSON
Consulting Engineers
Lynchburg, Va.

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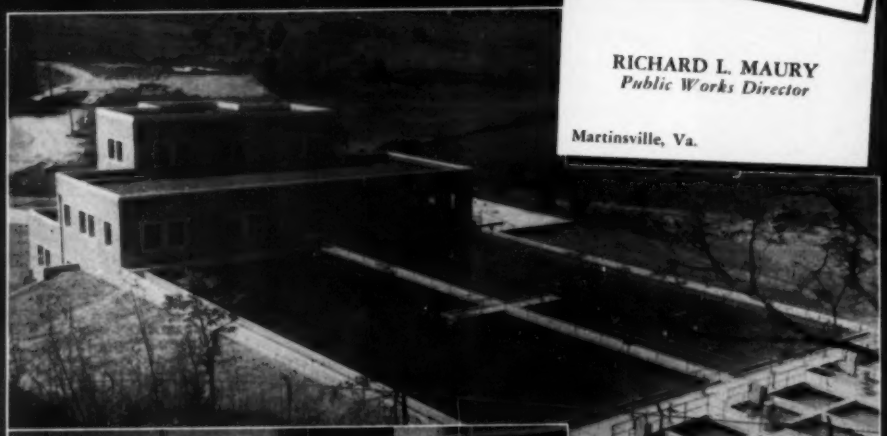
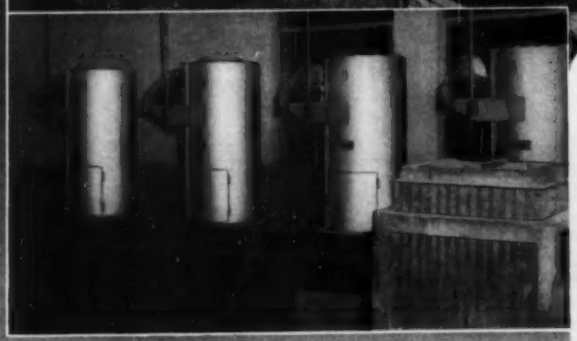
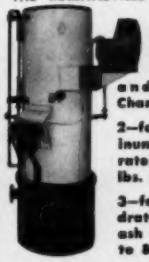
Public Works Director
Martinsville, Va.





OMEGA EQUIPMENT FURNISHED FOR THE MARTINSVILLE WATER WORKS:



5—#2 Universal Feeders with Hoppers, Hopper Agitators and Dissolving Chambers:

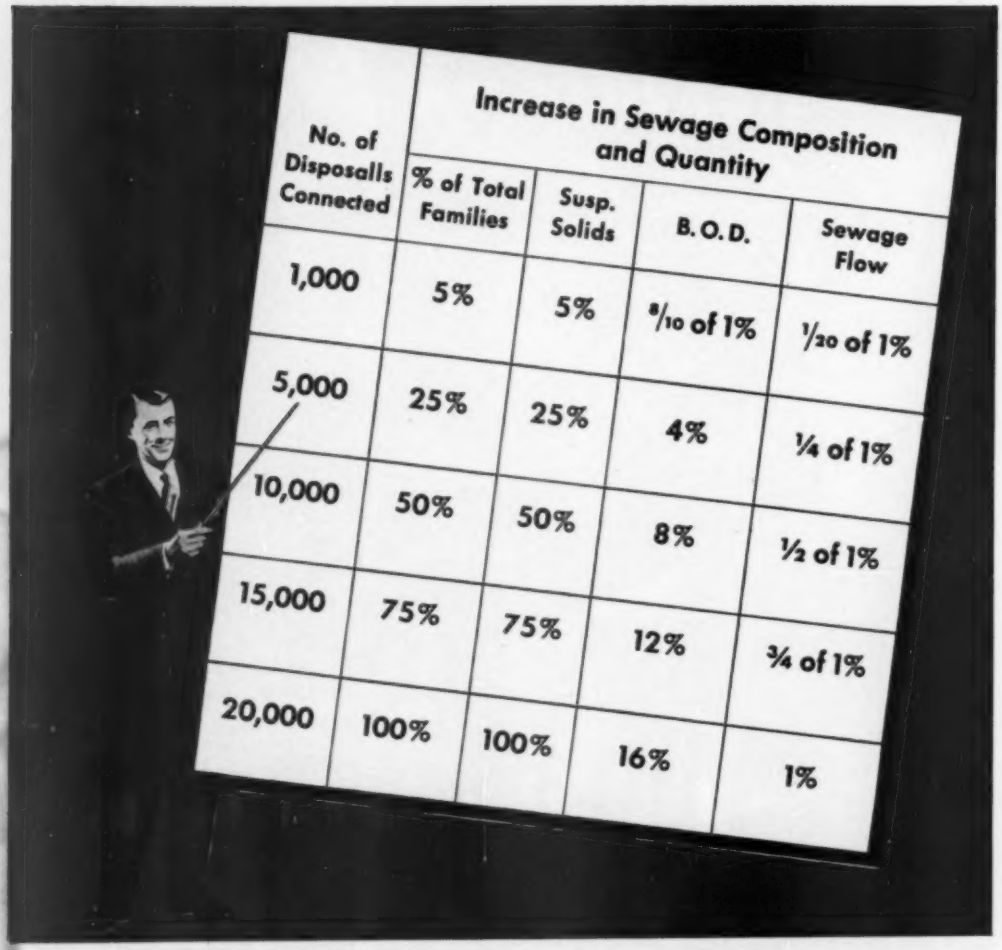
2—for feeding aluminum sulphate at rates from 1 to 100 lbs. per hr.

3—for feeding hydrated lime or soda ash at rates from 1 to 80 lbs. per hr.

To supply its increased water needs, the city of Martinsville has completed this new water works having a capacity of 5 MGD. The complete system comprises the Main Plant, the Pumping Station at Beaver Creek and Jones Creek, and the necessary rapid sand filters and treatment facilities to cope with the daily flows. Careful engineering has integrated these units into a well-balanced, workable operation — ideally suited to the production of high quality water. Omega Dry Chemical Feeders were specified by the engineers and installed by the contractor, Roberts Filter Manufacturing Company of Darby, Pa. These feeders deliver alum and hydrated lime or soda ash at the correct rates for coagulation and for control of pH of final effluent. For Bulletins describing Omega water works equipment, address Omega Machine Company (Division of Builders Iron Foundry), Providence 1, Rhode Island.

THE LAST WORD IN FEEDERS

OMEGA



We're glad you asked that question

HERE'S THE QUESTION most often asked by sanitation officials when first introduced to the General Electric Disposall*:

"Will this method of shredding food waste and flushing it into the sewer put too heavy a load on the sewer system and sewage treatment plant?"

Our answer to that important question has always been "No!" And it will be "No!" for many years to come.

When food wastes are ground, they are reduced to a far more uniform character than sewage solids themselves. Consequently, they flow even more readily through public sewer systems, they cause no stoppages, and they are readily treated at sewage treatment plants.

By applying the percentage lines shown above to your own city, you can see that in ten years the greatest number of Disposalls that might conceivably be installed would increase sewage flow gallonage less than ¼ of 1%.

The B.O.D. would be increased about 2.0% and suspended solids about 10%.

It is obvious that these increases could be adequately handled today without expanding the capacity of many plants. And remember, these increases are based on the assumption that one tenth of the homes in your community will have Disposalls within ten years. It takes many

years for an appliance as revolutionary as the Disposall to gain widespread usage. It will be ten years before even one home out of every ten has a Disposall.

The extra loading on the treatment plant caused by the Disposall method of garbage elimination will be but a "drop in the bucket!" for some years to come.

Of course, we can only answer for the General Electric Disposall, the product of years of careful development. And, because the Disposall is the pioneer in the field of scientific garbage elimination—and has proved itself in the laboratory and in countless homes—we can offer you our own strict list of specifications in the development of a dependable food-waste shredder.

We trust that these specifications—shown below—will be of value to you in judging all such appliances and in protecting the health, safety and economy of your community!

GENERAL ELECTRIC'S SPECIFICATIONS FOR ITS FOOD-WASTE SHREDDER— THE DISPOSALL

1. *The Disposall has a flow interlock that permits operation with cold water only.*

This requirement is necessary because experience has shown that only with cold water will greases become congealed within the cylinder. With congealed grease broken up into small particles, mixed with food waste and carried off through the drain, there can be little tendency for greases to adhere to the walls of the pipe.

2. *The discharge from the Disposall remains in a fluid state. The correct relationship between the amount of food waste and tap water is maintained by controlled shredding.*

This equalization of water and food waste is essential to permit the ready flow of effluent through traps, drain, or soil lines in a manner to prevent clogging.

3. *The Disposall shreds food waste to a uniform size, to meet the following requirements: 100% shall pass a ½-inch screen. At least 90% shall pass a ¼-inch screen. Not more than 5% shall pass a #40 sieve.*

(Screens should be the United States standard, and weight should be taken on a dry basis.)

In other words, the particles of shredded food waste are of the correct size, to permit effective sewage clarification and sludge digestion at the treatment plant.

4. *The food-waste shredder is self-scouring, with no fouling surfaces.*

This feature prevents objectionable odors; keeps the unit clean as a whistle.

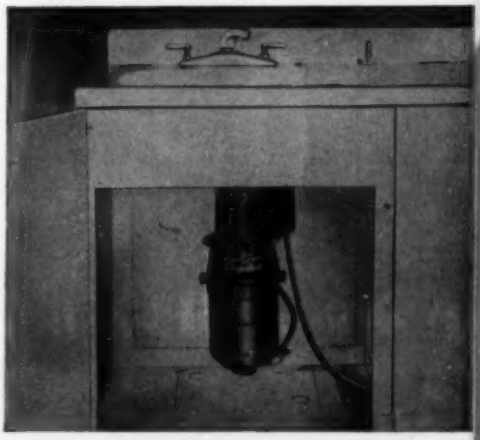
5. *The food-waste shredder provides maximum protection against electrical or mechanical hazards.*

As a safety measure, the shredding compartment is inaccessible during operation.

6. *The food-waste shredder is designed for connection to the plumbing, in accordance with the local plumbing code, and is free from any cross-connection.*

This regulation eliminates any makeshift, homemade hook-ups, and permits the proper operation from sink to sewage-treatment plant.

For further information about the Disposall method, simply write to Department WW-508, General Electric Company, Bridgeport 2, Connecticut.



The General Electric Disposall is easily installed in almost any sink. Here it is shown installed in our electric sink. Food waste is scraped into drain opening, and safety cover is placed in position. The cold-water tap is then turned on, starting the Disposall operation. Food waste is shredded and flushed away automatically.

P. S. Thousands of Disposalls are operating successfully on private septic tank systems.

Disposall

*General Electric's registered trade-mark for its food-waste disposal appliance

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

GENERAL ELECTRIC

1	Locating Leak
2	Breaking Through Pavement
3	Digging Bell Hole
4	Keeping Bell Hole Dry
5	Cleaning, Preparing Joint
6	**Purchase Price of Clamp**
7	Making Repairs
8	Backfilling
9	Repaving

What Price Permanence in Bell-Joint Repairs?

SO VERY SMALL is the cost of a Dresser Style 60 Clamp, compared to the total cost of a repair, that it makes permanence an outstanding bargain.

That's why so many cities make it standard practice to clamp bell-and-spigot joints whenever they are uncovered for *any* reason. Once installed, the Dresser Style 60 Clamp absorbs the vibration or movement that caused the leak. Eliminates the risk of losing your investment of time and labor due to failure of patchwork repair methods.

Whenever leaks occur in a bell-and-spigot line, whenever a joint is uncovered, whenever street paving is planned, whenever lines are subject to movement or vibration—"fix it once . . . fix it for good" with Dresser Style 60 Clamps.

Dresser Style 60's come in sizes from 3" to 60", and are fully adjustable for tight fit on all classes of pipe. Write today for literature and prices.

DRESSER BELL-JOINT CLAMPS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries) • In Texas: 1121 Rothwell St., Houston • In Canada: 629 Adelaide St., W., Toronto, Ont. • Sales Offices: New York, Philadelphia, Chicago, Houston, San Francisco.

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"let 'er roll"

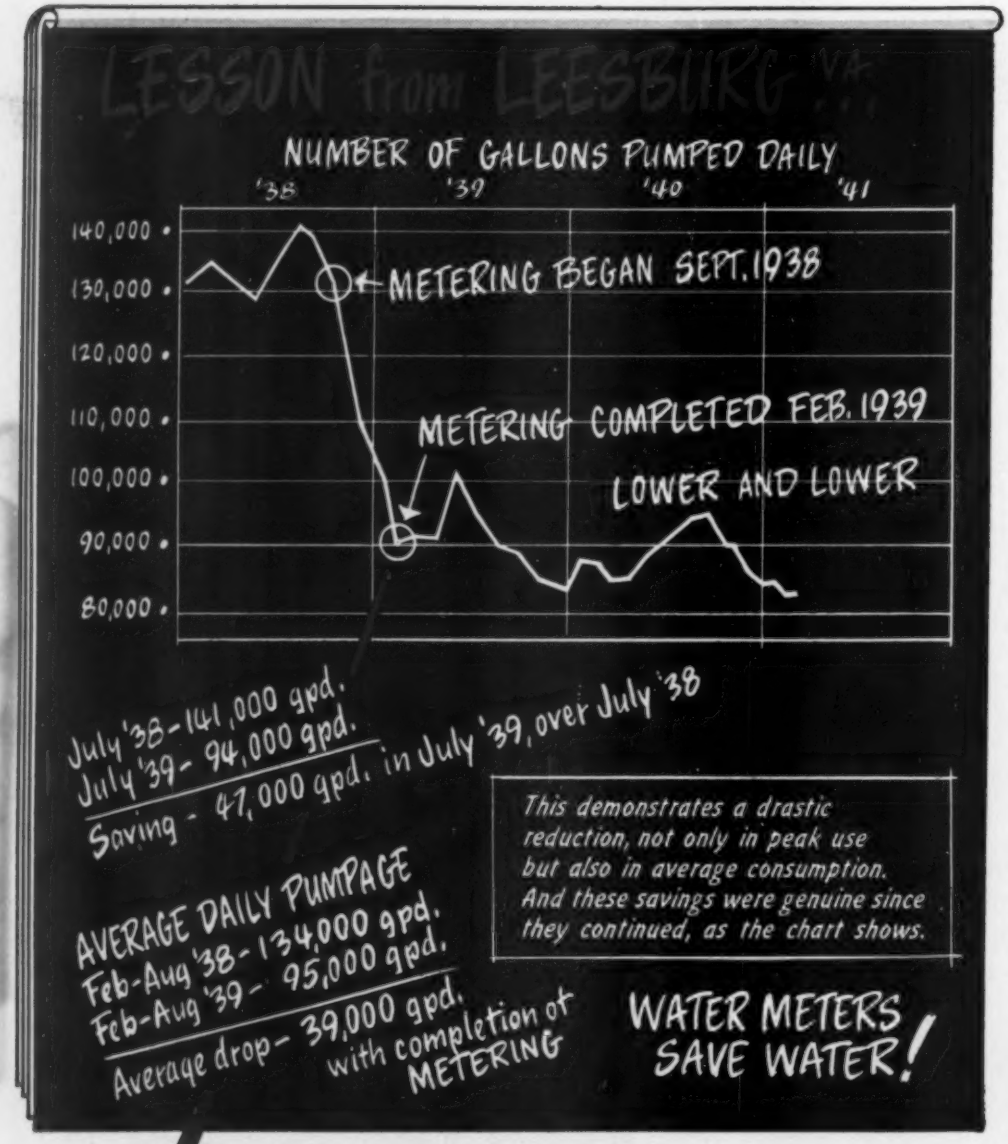
Whether they "roll" in tank cars,
or any other type of container, Niagara chemicals
are unsurpassed for quality.

- EBG* Liquid Chlorine
- NIALK* Caustic Potash
- NIALK Carbonate of Potash
- NIALK Paradichlorobenzene
- NIALK Caustic Soda
- NIALK TRICHLORethylene
- NIAGATHAL* Tetrachloro Phthalic Anhydride)

*Trade-mark

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York


LESSON from LEESBURG VA.
NUMBER OF GALLONS PUMPED DAILY
'38
'39
'40
'41
140,000
130,000
120,000
110,000
100,000
90,000
80,000
METERING BEGAN SEPT. 1938
METERING COMPLETED FEB. 1939
LOWER AND LOWER
July '38 - 141,000 gpd.
July '39 - 94,000 gpd.
Saving - 47,000 gpd. in July '39 over July '38
AVERAGE DAILY PUMPAGE
Feb-Aug '38 - 134,000 gpd.
Feb-Aug '39 - 95,000 gpd.
Average drop - 39,000 gpd. with completion of METERING
This demonstrates a drastic reduction, not only in peak use but also in average consumption. And these savings were genuine since they continued, as the chart shows.
WATER METERS SAVE WATER!

216

METERING ALONE IS NOT ENOUGH . . .

"It must not be taken for granted," writes a prominent Water Works General Superintendent and Chief Engineer, "that with the installation of meters all troubles come to an end. Meters must be properly maintained . . . Many a water company has become careless in meter maintenance, and as meter efficiency decreased, has looked to increased rates . . . A properly maintained meter department is the most important part of any water system." Trident Meters, simple, and rugged with 100% interchangeability of parts, are easy and economical to maintain, at "new meter accuracy" through years of constant service.

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WATER & SEWAGE WORKS

Vol. 97, No. 8 AUGUST, 1950

A Gillette Publication

SEWAGE TREATMENT PLANT EQUIPMENT

Sedimentation Tanks

The Third Article of a Series

by

FRANK L. FLOOD
PARTNER
METCALF & EDDY

SEDIMENTATION tanks have been designed in both rectangular and circular shape. Proponents of each design have their arguments and it is not the purpose of this article to comment on the merits of either.

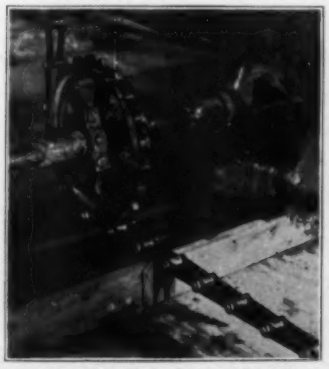
RECTANGULAR TANKS

Equipment of this type is in a highly competitive field. For fair competition and in order to obtain the best equipment available with reasonable assurance of satisfactory operation and long life, it is desirable to specify the equipment in considerable detail. Manufacturers of this type of equipment include Chain Belt Co., Jeffrey Manufacturing Co., Link Belt Co., and Walker Process Equipment Co.

The Author

Chain and Flight Construction

Mechanisms include chains, flights, sprockets, shafts, and drive unit. The chains should be rugged and durable. Specifications commonly require that the chains be for the pintle type and made of processed malleable iron such as "Supermal," "Promal" or "Z-metal" with an ultimate tensile strength of not less than 70,000 psi. (pounds per square inch). The required working strength of the chain can be readily determined by consultation with the manufacturers and



Columbus, Ohio—Jeffry Hunting Tooth Type Sprocket

(Sprocket is split, of alloy cast iron with chain saver rim)

Columbus, Ohio—Flight Equipped with Full Depth Attachments

(Note insert type wearing shoes)

Detroit, Mich.—One of 16 Collectors in Primary Sedimentation Tanks

should be included in the specification so that all will quote on the same basis. Chains have been supplied with copper-bearing riveted steel pins. There is evidence that these pins wear and produce excessive elongation resulting in wear on the sprockets. Recently some of the manufacturers have recommended that the pins be of hardened steel.

Attachments for the chains to the flights at one time were commonly designed for bolting to part depth of the flight. There has accumulated some evidence of the flights splitting, under this condition, longitudinally beyond the attachments. Some manufacturers recommend a full depth flight attachment in order to strengthen the flights against this splitting. Because of the competitive situation, it is necessary to specify the full depth attachment if it is desired.

Flights are commonly specified to be of redwood. For the smaller tanks, sizes of 1⅝ by 5⅝ in. dressed, are suitable. For some of the larger tanks sizes of 2⅝ by 7⅝ in. dressed, appear advisable. The flights ride on rails embedded in the bottom of the tank for the collection of sludge and upon angles supported from the sides of the tank for the return flight. Wearing shoes are provided on the flights. Johnson[1] reported that replacement of these wearing shoes caused excessive labor and expense and recommended removable wearing shoes as illustrated in Fig. 1 of his paper. We have adopted this as standard construction and our specifications require that "The flights shall be provided with chilled cast-iron wearing shoes inserted into malleable-iron holders bolted to the flights at points of contact with rails in the tank bottom and with supporting angles." The castings must be of such workmanship that the removable shoe will not shake loose during ordinary operation of the flights.

At the Minneapolis-St. Paul sewage treatment plant as reported to the writer by Kerwin L. Mick, Chief Engineer and Superintendent of the plant, the best answer to the shoe-wear problem, under the conditions at that plant, is the application by welding of two "Stellite" strips about ⅛ in. wide and about 2 to 2½ in. apart on each shoe. He reports that the wear on the bottom rails set in the concrete is not excessive and when it does occur, the situation is easily remedied by spot welding flat steel strips on top of the original rail. Some of such work was required in 1947 after seven years of operation with the "Stellite" strips.

Material improvements have been made in the sprockets. The "hunting

Minneapolis-St. Paul—Chain Belt Rex Sludge Collectors and Automatic Skimmers

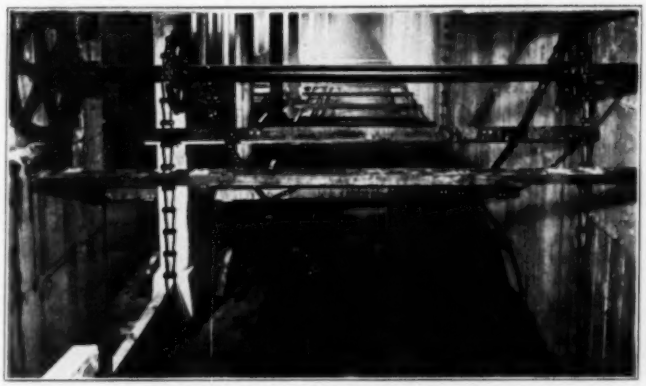
tooth" or "extended life" sprockets are claimed to reduce wear on sprockets by about 50 per cent. Several of the manufacturers have agreed that it is desirable to specify sprockets of alloy cast iron with a nickel content of 1.00 to 1.25 per cent and a chromium content of 0.45 to 0.65 per cent. The sprockets should be chilled to give them a hardened tooth surface.

Recently a survey was made of chain-and-flight type sludge collectors in primary sedimentation tanks at 10 sewage treatment plants in New England with from 9 to 16 years' operating experience. There were 49 individual longitudinal collectors operating on the average for 11 years. The aggregate experience in repairs and replacements for all of this equipment is as follows:

Drive chains, replaced in 2 tanks after 10 years of operation, a few links and pins replaced in 7 tanks.
Drive sprockets; 2 replaced.
Idler and take-up sprockets; 1 replaced, 1 redrilled.
Main chains; 1 broken link.
Flights; total of 20 replaced at 9 plants, replaced as broken at tenth plant with no record.
Flight shoes; no replacement at 7 plants, replaced after 11 years at 1 plant, replaced every 3 years at 1 plant and 12 individual replacements in 16 years at 1 plant.

Omitting one plant which operates the equipment continuously 24 hr. per day, the indicated life of the various parts, as reported by the operators, is 10 to 21 years for drive chains, 14 to 26 years for drive sprockets, idlers, and take-up sprockets, 13 to 24 years for main chains, 10 to 26 years for flights, and 3 to 19 years for flight shoes.

Mick of Minneapolis-St. Paul San. Dist., reports to the writer that all of the original main sludge collector chains in the Minneapolis-St. Paul sewage treatment plant sedimentation tanks placed in operation in 1938 are still in use. On two of the tanks, the chain would soon be worn through the barrel but it is planned to turn this chain over before that happens. The wear will then come on the other side of the barrel and it is expected that the life of the chain will be prolonged several years thereby.



Toledo, Ohio—Link-Belt Straight Line Collectors

Experience has disclosed that the life of the equipment may be prolonged and the cost of renewals and repairs reduced by operating the equipment in primary settling tanks for a few hours each day during sludge withdrawal operations. In small plants, chains and shoes which may require replacement at the end of 10 years for equipment operating 24 hours per day should last from 15 to 20 years if operated 1 to 3 hr. per day. For the largest plants more frequent replacement may be required.

Chain-and-flight construction is particularly adapted to covered sedimentation tanks as at Detroit, Boston Nut Island, Toronto Ashbridges' Bay, Los Angeles Hyperion primary settling tanks, among the larger plants; and Greenwich, Connecticut; Tonawanda, New York; Greenfield, Massachusetts; and Warren, Rhode Island, among the smaller plants. This type of construction is also advantageous for rectangular tanks in which it is desirable to remove the sludge rapidly and continuously so as to avoid deterioration in its quality.

Bristol, Conn.—Skimming Pipes for Scum Removal

Overload Release

The most common method of providing against damage to the equipment because of overload is by shear pins. However, if a shear pin breaks because of overload the temptation is strong to put in a stronger pin and attempt to get the equipment mov-

Automatic Grease Skimmer in Packing Plant

ing rather than to unwater the tank and find out the cause of the overload. Major damage to equipment has been caused by the substitution or use of improper shear pins.

Several adjustable overload release devices have been developed to mechanically disengage the collector from the motor when overloads are encountered.

The Chicago Sanitary District is well satisfied with the operation of individual motorized reducers on sludge collectors. The basis of this design has also been described by Johnson.[1] All parts except the flights are designed to withstand the torque of the motor. Consideration must be given to the motor size and to selecting characteristics such that the maximum torque is not materially greater than the running torque. Particular attention should be given to possible deflection of shafts and consequent effect on bearing mountings. Self-aligning bearings are helpful to prevent difficulties of the latter type.

It appears advisable to specify that bolts shall be not less than ½ in. diameter and structural steel shapes shall have a thickness of not less than ⅜ in.

Sludge Hoppers

Multiple hoppers for collection of sluge at the ends of rectangular tanks have caused operating headaches as the sludge tends to collect and hang up on the sides and in the corners. In time, this sludge becomes gas lifted and belches to the surface. The operator afflicted with this type of tank must spend considerable time pushing the sludge down to the bottom of the hoppers where it can be picked up by the pump suction. Even in relatively narrow tanks it appears advisable to provide cross collectors so that insofar as is practical, sludge is brought to the drawoff piping mechanically. In small tanks where longitudinal chain and flights have been used to collect the sludge at the ends of the tanks, it has in some instances proven practical to install cross collectors of the spiral conveyor type.

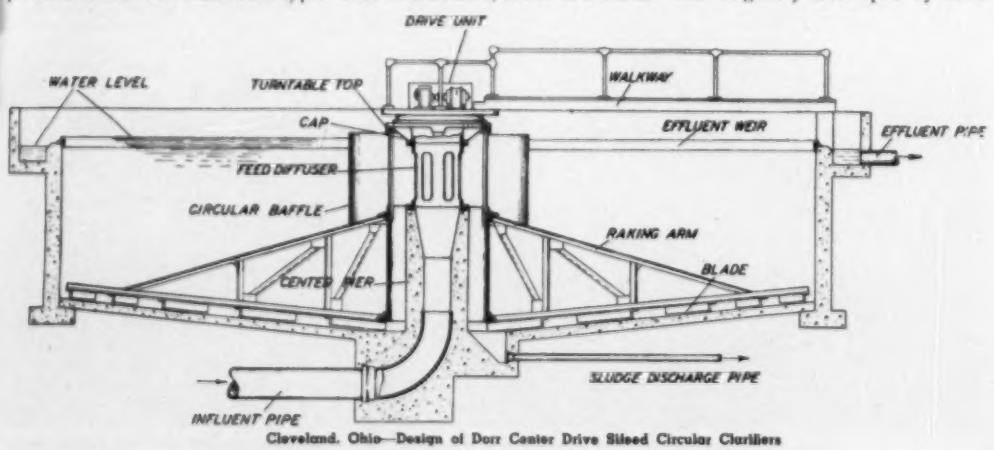
Scum Removal

Various types of mechanisms have been devised for withdrawal of scum from rectangular tanks equipped with chains and flights for sludge and scum collection. The rotated slotted pipe provides a simple means for manual control of scum withdrawal. (See accompanying cut for Bristol, Conn.) Where such manual control is too laborious it is possible to use mechanical means. One of the simplest mechanical skimmers consists of a rotating spiral squeegee which carries skimmings up a launder and discharges them into a scum trough, whence they are transmitted by water carriage to the disposal facilities. This type has been provided for the Los Angeles Hyperion primary settling tanks.

At the Boston Nut Island plant provision is made for conveying the scum while still floating on the sewage to one scum storage sump for each of two large rectangular tanks. The equipment is of the chain-and-flight type.

Crane-and-Bridge Type Construction

Prior to 1939, the policy of the Dorr Co. was to recommend circular clarifiers wherever possible. As competition developed for their equipment in the circular tank field and as rectangular tanks with common walls were often preferred by some engineers under certain circumstances, the Dorr Co. developed and advocated the Monorake for sewage sludge removal from rectangular sedimentation tanks. This equipment was originally developed by them



Cleveland, Ohio—Design of Dorr Center Drive Sliced Circular Clarifiers

primarily to meet the need for mechanical removal of sludge from sedimentation tanks following "flocculators" in water treatment plants. The Monorake type of sludge removal equipment is reported to be available for rectangular sedimentation tanks up to 60 ft. wide and any reasonable length. This type of equipment includes a balanced raking mechanism supported and operated from a carriage spanning the width of the tank and traveling on longitudinal rails. The carriage is operated by cables. The rakes are so set as to collect the sludge in one or more hoppers at the influent end of the tanks. The first large installation of this type was at the Coney Island plant in New York about eight years ago. The principal difficulty encountered has been with failure of the reversing switch to operate. It is understood that the manufacturer has improved the design in this respect. The average life of the cables at this plant is said to be about five years. Other items of equipment requiring occasional replacement are cable sheaves, flight shoes, carriage wheels, and bearings.

One of the main advantages of this type of mechanism is that the amount of equipment immersed in the sewage is reduced to a minimum and all equipment can be raised above the sewage level for renewals and repairs. Thus it is not necessary to unwater the tank for such work.

The Hardinge Co., Inc., makes sludge removal equipment for rectangular tanks consisting of a bridge crane which spans the width of the tank and supports the sludge scraper and skimmer. The sludge is collected in one or more hoppers at the influent end of the tank or in a trough equipped with a cross screw sludge conveyor.

Topeka, Kas.—Chain Belt Tow-Bro Sludge Removers

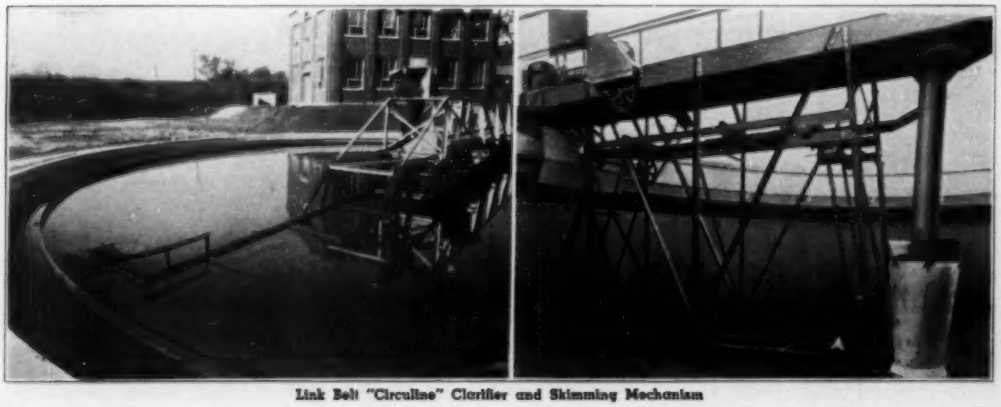
CIRCULAR TANKS

The Dorr Co. has been the outstanding manufacturer of sludge removal mechanisms for circular sedimentation tanks. Also in this field are Hardinge Co., Yeomans Brothers Co., Infilco, Inc., and Chain Belt Co.

In the Dorr Type S clarifier, feed is introduced through a centrally located, inverted siphon with the inlet surrounded by a submerged diffuser. From the center inlet, the sewage flows radially to a peripheral weir. A motor-driven revolving rake sweeps the settled solids to a central discharge hopper in the tank bottom. Representative installations include the primary settling tank at the District of Columbia and the final settling tanks at the Cleveland Easterly plant. L. M. Johnson[1] has described the advantages gained by the use of stalling torque motors to drive equipment of this type at the plants in the Chicago Sanitary District. The clarifiers in the 126-ft. diameter final settling tanks at the Chicago Southwest plant are driven by ½-hp. motors through 69,500 to 1 combination helical and spur-gear speed reducers. The motor constitutes the only protective device throughout the entire gear train.

Tanks of this type afford only a small hopper for sludge accumulation. For the Dorr clarifier at the Terminal Island plant in Los Angeles, the operators report that it is desirable to provide automatic programmed intermittent operation of the raw sludge pumps in order to withdraw reasonably well concentrated sludge.

In very large circular final settling tanks, wind curents and high rates of weir discharge for a single peripheral weir have been reported to induce the discharge of unduly large quantities of suspended solids with the tank effluent. The unit weir discharge rates may be substantially reduced by the provision of supplementary weir capacity in connection with an effluent trough built within the tank



Link Belt "Circuline" Clarifier and Skimming Mechanism

and supported from the outside wall.

There is evidence to show that, on the average, the cost of maintenance, renewals, and repairs on sludge removal equipment in circular tanks is relatively low.

The sludge withdrawal pipelines from circular tanks are of necessity longer than for rectangular tanks. There is very little evidence to show that this has caused unusual operating difficulties except at the Buffalo plant. Here the sludge withdrawal lines became plugged with grit and heavy sludge to a serious extent as reported by John W. Johnson.[a]

Various devices have been developed for collection of scum on the surface of circular primary sedimentation tanks. The collection is sometimes effected by wind currents. Several instances have been observed where the operators have improved upon the standard form of scum collector supplied by the manufacturer but the improvements have not been described in the technical literature.

References

[a] L. M. Johnson, Mun. Sanit., Nov. 1938, p. 529.
[a] J. W. Johnson, Sew. Wks. Engr., Aug. 1944, p. 386.

GAIL P. HATHAWAY NOMINEE FOR ASCE PRESIDENCY

Gail A. Hathaway, Special Assistant to the Chief of Engineers, Department of the Army, Washington, D. C., has been officially nominated as the next President of the American Society of Civil Engineers for the year 1951. Such nomination is tantamount to election, which follows by letter ballot.

Internationally known in the field of water resource development, Mr. Hathaway has filled many important war and postwar assignments for the government. From November 1944 to March 1945, he acted as Special Adviser to the Chief Engineer, European Theater of Operations, in connection with the organization and operation of the Rhine River Flood Prediction Service, which furnished important data to the Allied Armies prior to their crossing of the river. For his work on this mission Mr. Hathaway received a Presidential Citation and the Bronze Star Medal. In 1946 he was engineering consultant to President Truman's Cabinet Committee on Palestine during meetings held in London. On that mission, he investigated and reported on potential water resource development in Palestine and adjoining countries of the Middle East. He has also been a member of the Inter-Departmental Committee of the United Nations Scientific Conference on Natural Resources, and he is the present chairman of the United States Committee of the International Commission on Large Dams World Power Conference.

A graduate of Oregon State College and veteran of World War I, Mr. Hathaway began his career with the Corps of Engineers in 1928. His assignments have included the hydraulic design of Fort Peck Dam in Montana, largest hydraulic earth-fill dam in the world. He was also consultant on hydraulic design studies for other large Corps of Engineers dams.

Mr. Hathaway was made Special Assistant to the Chief of Engineers in 1945. In this capacity he serves as technical adviser to the Chief of Engineers on policy and engineering matters related to the civil works and military programs of the Corps of Engineers.

Mr. Hathaway has contributed to the advancement of the engineering profession through work in numerous professional and scientific organizations, in addition to the American Society of Civil Engineers, which he has served as Director and Vice-President.

19TH ARKANSAS WATER AND SEWAGE CONFERENCE

According to Harrison P. Hale, Secretary, the 19th Annual Arkansas Water and Sewage Conference had a record attendance of 191 when held in the Municipal Auditorium at Little Rock, Ark.

During the past year there has been a striking development of the seven district conferences which meet monthly. These have given much impetus to the Voluntary Licensing Plan and more than 40 persons took the examinations this year.

The conference covered such topics as source of supply, purification, pumping, distribution, metering, and the treatment of sewers and sewage.

Officers elected for the ensuing year include: Chairman, Elmo A. Lambert, Clarendon; Vice Chairman, Cecil A. Brown, Pine Bluff; Secretary, Dr. Harrison E. Hale, Fayetteville; and Program Chairman, Jack H. Wilson, Little Rock.

INVENTION AN EVOLUTIONARY PROCESS

In Which Prior Art and Early Invention is Considered the "Basic Knowledge"

by

PAUL S. BOLGER
Member, N.Y. Bar*
NEW YORK

A QUESTION which is frequently asked by those who are unfamiliar with the granting of patents and patent law is: "How can a patent be obtained for a particular device or process, when similar devices or processes have been known and used for many years?" Certainly this is a question which has at times also confounded those intimately associated with patent law. It is believed that the question is asked when it is not understood that the later development is not an attempt to appropriate the earlier devices but is an addition to the fund of knowledge represented by the earlier device. There is always a certain predisposition to regard the future with concern, and reflect on the glories of an earlier period. A feeling that the millenium is past. This quite typical reaction when projected into the field of invention and patent law gives rise to the attitude that all basic or important inventions have been made and that contemporary developments are trifling and a mere carping of the past. This attitude of the static nature of development is not new, for in the 19th century no less than a Commissioner of Patents is reputed to have stated in his annual report that the time was near when inventive development must end. When viewed in the light of the great inventive developments which have followed in ever increasing numbers since the gloomy prediction of the commissioner, we are brought to the realization that a similar attitude with regard to further advance in the present day may be equally fallacious. However, it is the same predisposition to regard inventive development as static which prompts the question set out above.

The fact is that tremendous technical advance has been made within the last century and the indications are that the tempo of development is ever increasing. Furthermore, it has frequently been seen that each new advance rather than indicating that a plateau of development has been reached reveals, instead, new vistas of unconquered heights to be achieved.

*Admitted to Practice before the U.S. Patent Office.

This article has been written by Mr. Bolger on invitation.

In our April 1950 issue we published an article on "The Sludge Blanket Clarifier—A Chronological Look at Its 80 Year History" which has been roundly criticized by patent attorneys and likewise by manufacturers of the up-flow type of clarifiers.

Insofar as we have been able to ascertain, no one has branded the author's statements as untrue but from patent attorneys there has come the criticism that the author's statements concerning the examiners in the Patent Office were immoderate and unduly critical and, thereby, likely to give the readers of *Water & Sewage Works* the general impression that patents of doubtful value were being granted without due consideration as to prior invention and the known art.

So challenging were the comments by many on Mr. Prager's article that we felt it rather imperative that we publish something in the nature of an explanation of the underlying considerations in the Patent Office's examination of patent applications and the granting of patents.

We, therefore, present the accompanying article by Mr. Bolger, which we are pleased to publish in order that our readers may have a clearer understanding of the mechanism of patent application examinations, and the underlying basis on which a patent is granted when known art and prior invention might appear to negate patentability.

When is a "Basic Invention" Not Basic

To answer in part the question as to how further patents may be obtained when prior art or similar devices have been known, it may be said that the earlier devices usually have only certain basic similarities with the later day devices which may have been granted patents. Although superficially there is identity actually, it is only a "family resemblance." Certain prior inventions are referred to by the misleading term of "basic inventions," which it is believed is but a reflection of the static habit of thinking. An invention may be conceived in some prior period which performed or achieved some desirable or useful result, and later devices appear to be merely repetitious of the earlier basic. However, in fact, the later developments may and frequently are the means of bringing to complete fruition and greater usefulness the earlier invention, in whole or in part, which has by the passage of time become regarded as a "basic" invention. Who can truly assess the relative worth of the two inventions, the earlier invention, in point of time, which yielded certain crude imperfect results or the later invention which yielded a more practical and useful product or device. Those who might be tempted to consider the earlier invention as the important basic advance should be reminded that the earlier invention may have had its antecedents, and in its day was considered merely an improvement on existing knowledge.

A Case at Point

The incandescent electric light of Thomas Edison, when viewed in the perspective of time stands as a truly great invention, and one upon which many would bestow the title of "basic invention." In any event it will be generally conceded that the invention of Edison formed a part of the "basic knowledge" upon which later day improvements to electric lamps was founded.

However, in its day the patent[1] on the Edison lamp was challenged on many sides. During the course of litigation with regard to the patent, patents on earlier similar devices were introduced. Evidence was adduced to show that the Edison device was but slightly different from prior devices. Nevertheless, the courts recognized the validity of the important claim 2 of the patent. Edison had made an improvement which, by a new combination of elements disclosed by earlier devices, yielded a more desirable result. Some of the earlier devices had worked in a crude imperfect fashion, Edison's device yielded more useful results. In the same manner it may be said

[1]Patent No. 233,898.

that the modern electric lamps with their bright, glowing light are still more useful than the crude dim lamp which was the early Edison device, and the inventions which gave rise to the present day electric lamps are improvements, just as the Edison device was an improvement in its day.

Another Famous Case

Barbed wire, a seemingly simple development, was in fact the result of the work of several men. Finally Glidden devised a crude form of device somewhat similar to the barbed wire known today, in which a short piece of wire was coiled about one wire strand to form a barb and a second wire strand was intertwisted therewith to lock the barb in place.

Glidden was granted a patent[1] for his barbed wire but many contested the novelty of his device. However, after years of litigation the validity of the patent was affirmed by the United States Supreme Court in the now famous Barber Wire Patent Case[2]. During the course of litigation evidence was adduced to show that prior barbed wire devices had used metal spurs, and there was even one prior device which suggested locking the spurs in place by using an inter-twisted wire.

The inventions of Edison and Glidden are but examples chosen at random, but a similar situation is generally found when other great inventions of the past are compared with their prior art.

Invention an Evolutionary Process

The devices of the past evolved by their inventors were based on the accumulated knowledge at that point in time, and each in their time becomes a part of a growing fund of knowledge, a foundation made up of many individual contributions, upon which each succeeding invention builds. The progress of invention, therefore, may be considered an evolutionary process in which the improvement of today is part of the base for the improvement of tomorrow.

As the evolutionary process of invention continues new patents are granted in recognition of the contributions made to the advance of the general fund of knowledge. The United States Patent Office, as the official agency for granting patents, receives all new patent applications which are duly submitted, and evaluates them in the light of prior domestic patents, and to a lesser extent an evaluation is also made with regard to prior foreign patents and domestic and foreign technical publications which are extant at the time of the receipt of new applications. The Patent Office Officials who examine all the applications are technically trained specialists, who are well qualified to determine the relative merits of each new application in terms of the prior developments.

For purposes of examination of the new inventions of an applicant all prior patents are classified according to subject matter and suitably cross-indexed where necessary to assure complete classification. The examination of each application is delegated to a division of the Patent Office which specializes in devices, products or processes of the particular field. Accordingly, decisions as to patentability based upon the impartial examining staff are presumptive evidence of the validity of the patents when issued by the Patent Office.

The Claims of a Patent are What Count

The examining officials of the Patent Office determine whether there has been a patentably distinguishable advance and grants patents on those features of an invention or improvement in the field which they consider are claimed with proper limitations, for although the application may in the description of the device embodying the improvement include many features of prior devices, only the specific *claims* are the portion of the patent which define the area of exclusive grant. The description is merely used to place the improvement in its proper setting so that it may become an immediately useful part of the general fund of knowledge in the patent field. The patent which is granted is a reward for the contribution to the general advance of technical knowledge and reserves to the inventor the exclusive right to the manufacture, use of and sale for the 17 year life of the patent. After the patent has expired, the public is free to use, make and sell the improvement. It should be noted, however, from the day the patent issues the knowledge of the improvement is open to all so that the steady advance of knowledge is not hindered by the exclusive nature of the grant. The Patent Office, in determining whether the application includes a patentably distinguishable improvement, makes a comparison of the improvement described and *claimed* in the new application with the disclosures of earlier patents. If there is truly an improvement, such that yields a more desirable result of simpler construction or which in some way presents a new and useful development, even though the change in the prior art to bring about the improvement seems relatively small, a patent will be granted on that limited area of improvement, or on a combination of prior improvements yielding a *novel* further improvement.

Validity is Determined Only in the Courts

In its evaluation of a patent application, the examining officials of the Patent Office consider whether the matter submitted is new and useful, not merely the equivalent of an earlier device. Based on their findings, they make the determination as to whether sufficient invention is present to warrant the granting of a patent. After a patent is issued and, when, at a later time, it becomes involved in litigation before the Federal courts, the questions of *novelty*, *utility*, and *invention* are reexamined on the basis of evidence of prior publications, patents and prior actual installations, some of which may not have been available to the Patent Office. As a result of the review, by the courts, on some occasions the judgment of the Patent Office with regard to patentable novelty may be found erroneous because of the additional information which has become available to the court. In such instances the issued patent is invalidated. Often, however, the patents are invalidated not because there was an earlier device, which was an anticipation, but because the courts in applying a more severe test of invention determine that the advance or improvement claimed by the patent did not require invention to produce and was, therefore, not a sufficiently important contribution to warrant the issuance of a patent.

The method by which the courts determine whether invention exists or does not exist is veiled and confounded by numerous pronouncements. It is sufficient to note, however, that in the evolutionary process of development or invention, by which a constantly increasing fund of knowledge is created, each improvement is a new increment to that fund and later in point of time becomes the basis for further improvements. It is a vital rather than static process, which the Patent Office implements and encourages by granting successive patents for those improvements which are patentably distinguishable from earlier improvements which have by the passage of time become the "basic knowledge."

[1]Patent No. 157,124.

[2]Washburn & Moen Manufacturing Co. v. The Beat'em All Barbed Wire Co., 143 U.S. 275.

GRAPHICAL APPROACH TO STATISTICS

Part II Normal Probability Paper

by

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Professor and Chairman
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THIS second article will deal with the construction and use of normal probability paper. The bell-shaped probability curve developed in the previous article can be reduced to a straight line in the form of probability paper which facilitates the graphical solutions of many statistical problems.

The first step in the construction of normal probability paper is the transformation of the bell-shaped distribution curve to the probability summation or the ogee curve. The bell-shaped curve and its integration graph, Fig. 3, (see the preceding article in the May issue of *Water Sewage Works*) give the areas of the central portion about the mean working outward toward the tail of the curve. The The probability summation or ogee curve starts in the extreme left tail at minus infinity and sums the area by successive intervals toward the right. These two forms are shown in Fig. 4 (A), the bell-shaped distribution curve, and (B) the summation or ogee curve, both referred to an X'-axis scale in deviations from the mean expressed in terms of standard deviation.

The ogee curve can be constructed readily from the increments of area obtained from the integration graph, Fig. 3. The percentage of the area up to any deviation below the mean is simply obtained by subtracting from 50 per cent, the area obtained from the integration graph for that deviation; and for deviations above the mean, by adding 50 per cent to the areas of the integration graph, Fig. 3. For example, the summation of area up to a deviation of -1σ below the mean is (50 — 34.13) or 15.87 per cent, while the summation of area up to $+1\sigma$ above the mean is (50 + 34.13) or 84.13 per cent.

These two points are located on Fig. 4 (B) at (a) and (b) and similarly any number of other transformation can be made forming a complete smooth ogee curve.

The next step is to reduce the ogee probability summation curve to a straight line. This is simply done by projecting the points on the ogee curve vertically to the linear X'-axis scale and writing opposite each its corresponding percentage. For example, point (a) is projected to (a') and writing its probability summation 15.87 per cent; (b) projected to (b') and writing 84.13 per cent; etc. Figure 5 (A) is such a scale enlarged and Fig. 5 (B) is a scale of a size convenient for transfer to an 8½ x 11 in. sheet. These scales constitute the X-axis of *normal probability paper.*

The Author

Since the probability summation is the cumulative area from left to right, it represents probability *equal to or less than.* This is a useful expression as it affords an opportunity to determine readily the probability of not exceeding a certain magnitude of measurement.

For example, arranging the series of data of suspended solids determination of sewage (Table 1) in ascending order of magnitude automatically places the data in the order of their probability *equal to or less than.* Thus, by the simple technique of arranging data in order of magnitude we place them in the order of their position on the probability summation scale of normal probability paper.

If the distribution is truly normal, these values so arranged form a perfect straight line on the paper. Obviously, it is easier to deal with a straight line than the complicated bell-shaped curve. There remains, however, the problem of determining the plotting position of a number of measurements on the probability summation scale.

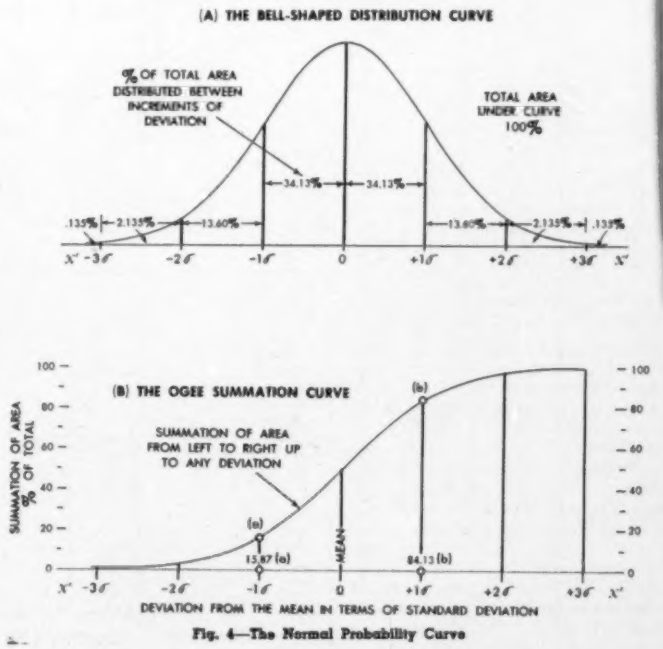


Fig. 4—The Normal Probability Curve

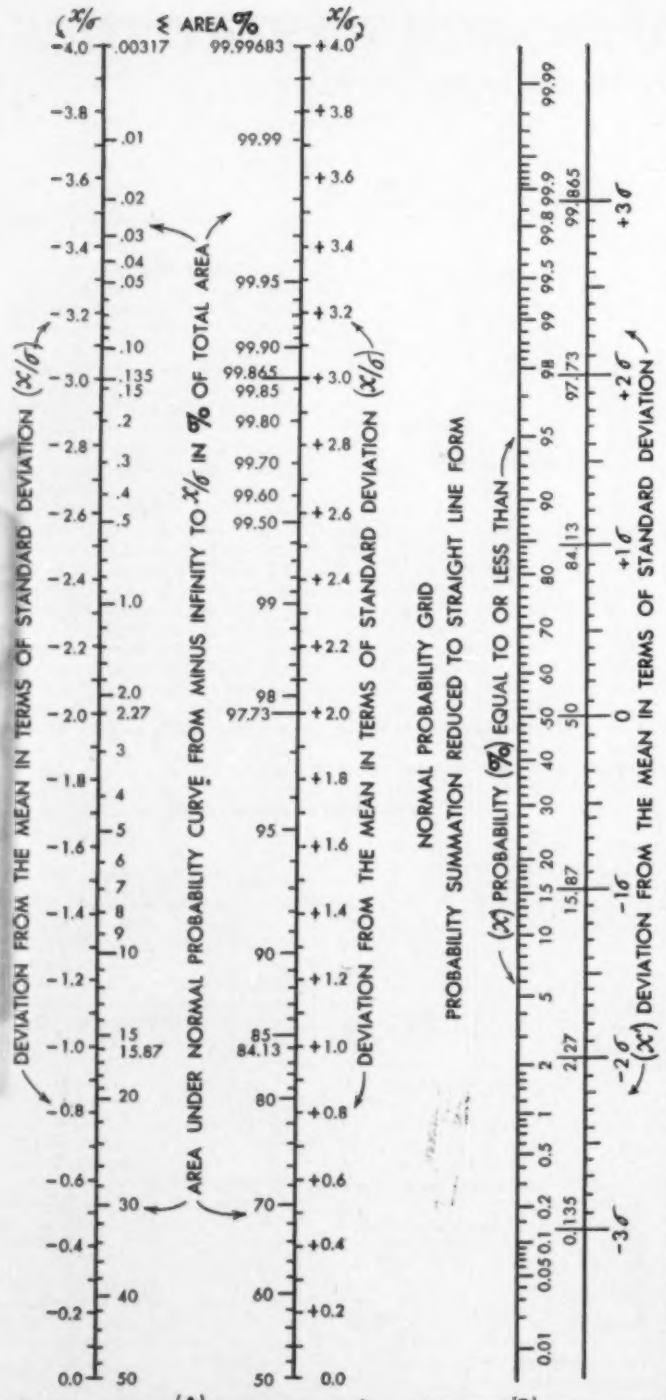

DEVIATION FROM THE MEAN IN TERMS OF STANDARD DEVIATION (x/σ)
AREA UNDER NORMAL PROBABILITY CURVE FROM MINUS INFINITY TO x/σ IN % OF TOTAL AREA
Σ AREA %
DEVIATION FROM THE MEAN IN TERMS OF STANDARD DEVIATION (x/σ)
NORMAL PROBABILITY GRID
PROBABILITY SUMMATION REDUCED TO STRAIGHT LINE FORM
(X) PROBABILITY (%) EQUAL TO OR LESS THAN
(X') DEVIATION FROM THE MEAN IN TERMS OF STANDARD DEVIATION
(A)
(B)

Fig. 5—Normal Probability Grid (see text)

The Plotting Position

Let us refer for a moment to the definition of probability given in the first article, namely, the ratio of the number of occurrences divided by the total number of trials. Applying this to the series of 20 determinations of suspended solids of sewage shown in Table 1 leads to the following:

CASE I. The probability of a value equal to or less than the smallest value, the first, would be 1/20 or 5 per cent; two values were observed equal to or less than 103.4 thousand pounds, probability 2/20 or 10 per cent; and finally 20 values are equal to or less than the largest value or 20/20 or 100 per cent. Immediately we face the dilemma, if we plot the first point at 5 per cent on the probability summation we will not be able to plot the last point because it is positioned at 100 per cent which is located at plus infinity, completely beyond our scale. This is equivalent to saying that the largest value which was actually observed to occur once in 20 would occur only once in an infinite number of observations.

CASE II. Similarly, if we reverse the scale and start at the large end and number the values in descending order of magnitude and express probability as equal to or greater than, the largest value would be plotted at 1/20 or 5 per cent, but now we would be unable to plot the smallest value as its probability would be 20/20 or 100 per cent which would be located at minus infinity, completely off the scale.

CASE III. Hazen[1] suggested what appeared to be a solution; plot the first value at the midpoint of equal increments on the scale of 100 per cent. For example, the increment for the 20 points would be 100/20 or 5 per cent. The first point being plotted at ½ of 5 or 2.5 per cent; the second point at 2.5 + 5 per cent or 7.5 per cent; etc., successively to the 20th point at 97.5 per cent. This permits plotting all of the values on the scale, and at first thought appears to solve the problem; but this does violence to the probability of the extreme values, the first and last points. Placing the smallest value of 20 values in a position on the probability scale at 2.5 per cent is ascribing to it a probability as though it were the smallest value of a series of 40 measurements, 100/2.5. In like manner, placing the largest value of 20 at 97.5 per cent is to ascribe to it a position as though it were the largest value of a series of 40 measurements. Obviously, such

[1]Hazen, Allen. *Flood Flows*, John Wiley & Sons. 1930.

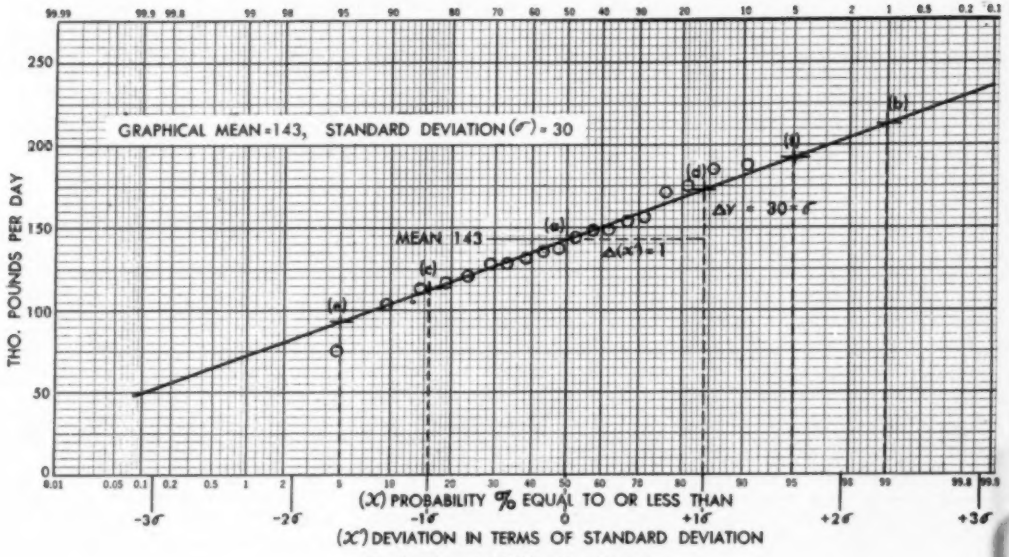


Fig. 6—Suspended Solids—Raw Sewage
(After Buffalo Sewer Authority)

positions of the probability of the end points cannot be accepted.

CASE IV. Theoretically, the plotting position for the mean of any series regardless of number of values is at 50 per cent and ½ of the values should be above and ½ below. If the mean is considered as part of the series the number of plotting positions becomes n + 1. On this basis the plotting positions of the observed values are obtained from the relation $\frac{m}{n+1}$ in which *m* is the serial number of the measurements arranged in ascending order of magnitude and *n* is the total number of measured values to be plotted. Thus, the plotting position for the first value of a series of 20 values would be 1/21 or 4.77 per cent; the 2nd, 2/21 or 9.53 per cent, etc.; and the 20th value, 20/21 or 95.23 per cent.

Under these conditions it will be noted that the first and last values in the series of 20 will be ploted in positions as though they are the smallest and largest values in a series of 21 values (100/4.77), with 10 values above 50 per cent and 10 values below 50 per cent. These plotting positions are more consistent with theory and with the facts as observed, and Case IV is therefore recommended.

Plotting on Normal Probability Paper

In summary, the procedure for plotting observed or experimental data on normal probability paper is as follows:

1. Arrange the data in order of ascending magnitude.

2. Assign a serial number "m" to each of the n values 1, 2, 3.....n.

3. Compute the plotting position of each serial value, giving the probability equal to or less than for each value by the expression $\frac{m}{n+1}$ expressing the ratio as a percentage.

4. The scale by which the observed or experimental data were measured is then laid off on the Y-axis and the plotting positions are the probability scale on the X-axis. The points are plotted, using these (X, Y) coordinates.

The proper evaluation of data in sewage works operation and stream pollution studies cannot be accomplished by simple mathematical averages of a series of analytical results. "Statistical evaluation offers the only means of condensing raw data to concise form, permitting significant interpretation," according to the author. This series of articles on the "Graphical Approach to Statistics," has been prepared especially for *Water & Sewage Works* to show how the usual forbidding methods of statistics can be used by means of graphic solutions. These articles may well revolutionize future work in this field with particular reference to water and sewage analysis for chemical and bacteriological constituents.—The Editors.

Interpretation:

1. If a straight line develops in the plotting, it indicates that the data have a normal distribution; that is, in accordance with the theory of probability we expect results distributed in this manner.

2. If a straight line does not develop in the plotting, we suspect that something is changed in the conditions affecting the observed measurement beyond what is normally expected. This might mean carelessness in measurements or it may mean that we had not measured the same characteristics under the same conditions or that we had been measuring at the same time two or more distinctly different things. These very useful interpretations are visually and immediately apparent in the graphical presentation on probability paper.

Graphical Determination of the Mean and the Standard Deviation

Following the above procedure, the 20 determinations of suspended solids of sewage shown in Table 1 are plotted on normal probability paper, Fig. 6. Inasmuch as the distribution forms a straight line (is normal), it is readily possible to determine graphically[1] the mean of the series and[2] the standard deviation from the mean, measuring the degree of variation among the data.

The mean is at once determined where the straight line of the distribution intersects the vertical line extending from 50 percent on the X-axis at

(a). The magnitude of the mean is read directly on the Y-axis as 143 thousand pounds per day.

The standard deviation is the slope ($\Delta y/\Delta x'$) of the distribution line on probability paper. If there were no variation in the individual measurements, all values would be exactly alike and would plot exactly as a horizontal straight line. The angle from the horizontal position, therefore, is a measure of the degree of variability of the data; the steeper the slope the greater the variability.

Since the probability summation scale was constructed linearly in terms of standard deviation from the mean, the slope of the distribution line measured on the standard deviation scale at once provides the standard deviation. Extending vertically from $+1\sigma$, one standard deviation from the mean, Δy, can be read directly from the graph on the Y scale as 30 thousand pounds per day. (The slope (σ) can be determined from any corresponding $\Delta y/\Delta x'$ along the line.)

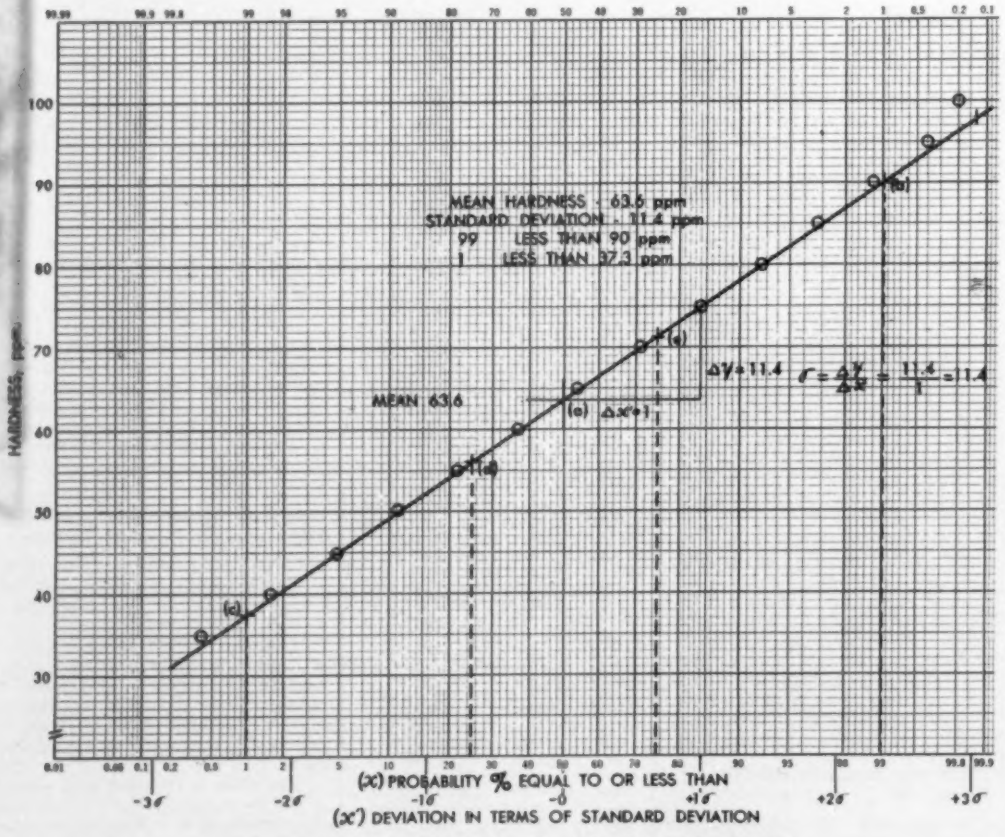
Table 1

SUSPENDED SOLID IN DAILY RAW SEWAGE FLOW

(Data courtesy Geo. Fynn and Geo. E. Symons, Buffalo Sewer Authority)

Suspended Solids 1000 lb./Day arranged in order of magnitude	Rank Serial No. (m)	Plotting position, Probability—Equal to or less than (m/(n+1) in %
(1)	(2)	(3)
72.6	1	4.8
103.4	2	9.5
112.8	3	14.3
117.1	4	19.0
120.7	5	23.8
127.9	6	28.6
128.9	7	33.3
131.3	8	38.1
135.4	9	42.9
137.5	10	47.6
143.9	11	52.4
148.4	12	57.1
148.8	13	61.9
153.9	14	66.7
155.2	15	71.4
170.9	16	76.2
176.0	17	81.0
185.0	18	85.7
188.6	19	90.5
194.2	20 = n	95.2

In addition to visually summarizing our data, graphically supplying the mean and the standard deviation from the mean, plotting on normal probability paper affords an opportunity to extend our series beyond the number of observations and determine the expected magnitude of a value at any probability equal to or less than. For example, referring to Fig. 6, if we wish to know the expected magnitude of a value that not more than 1 percent of the values are equal to or greater than, that is 99 per cent equal



7—Variation in Hardness in Softened Water Supply Based on 500 Determinations

to or less than, we extend vertically from 99 per cent on the X-axis to intersect the distribution line at (b) reading on the Y-axis 212 thousand pounds per day.

We also can make interpretations concerning confidence and precision in any range of deviation about the mean. For example, we are 68 percent confident of enclosing the quality within the range of 113 to 173 thousand pounds per day, located directly on the distribution line at the points (c) and (d), vertical extensions from 16 and 84 per cent, that is 34 per cent on either side of the mean. Similarly, we are 90 per cent confident of enclosing the quality within the range of 93 to 193 thousand pounds per day, located by (e) and (f), vertical extensions from 5 and 95 percent on the X-axis, 45 percent on either side of the mean.

Thus from the plot on probability paper we can read directly the probability of any range of deviation or the probability of not exceeding any magnitude of measurement.

Plotting a Large Series

The example of Fig. 6 deals with a small number of measurements, and no difficulty is encountered in plotting each individual measurement. In the event the series of measurements comprises a large number of values it becomes confusing the plot each individual value, and it is preferable to *group* the data. For example, suppose we have taken during a year 500 measurements of hardness of a softened water supply and we wish to summarize the data and define the variation by plotting on probability paper. The scale of measurement in ppm. has been divided into 5 ppm. intervals and the hardness results have been sorted into each group as shown in Table 2.

Table 2

HARDNESS OF SOFTENED WATER SUPPLY—1949

Group Hardness ppm (Y) (1)	Frequency (2)	Summation of Frequency (m) (3)	Percent less than (m/(n+1) as % (X) (4)
30 —34	2	2	0.4
35 —39	6	8	1.60
40 —44	16	24	4.8
45 —49	32	56	11.2
50.0—54	53	109	21.8
55.0—59	74	183	36.5
60.0—64	87	270	53.8
65.0—69	85	355	70.9
70.0—74	66	421	84.0
75.0—79	42	463	92.4
80.0—84	22	485	96.8
85.0—89	10	495	98.8
90.0—94	4	499	99.60
95.0—99	1	500	99.80
	n = 500		

Summing the number of values found in each group gives the number less than the divisions of the group intervals, which corresponds to the serial number (m) as shown in Column 3. The plotting position (Column 4) on the X-axis of the probability paper is m/(n+1), expressed as percent, where *n* is 500, the total number of values. The coordinates (Y) Column 1 and (X) Column 4 are then plotted on probability paper as shown in Fig. 7. The straight line formed summarizing the entire 500 values indicates a normal distribution, with a

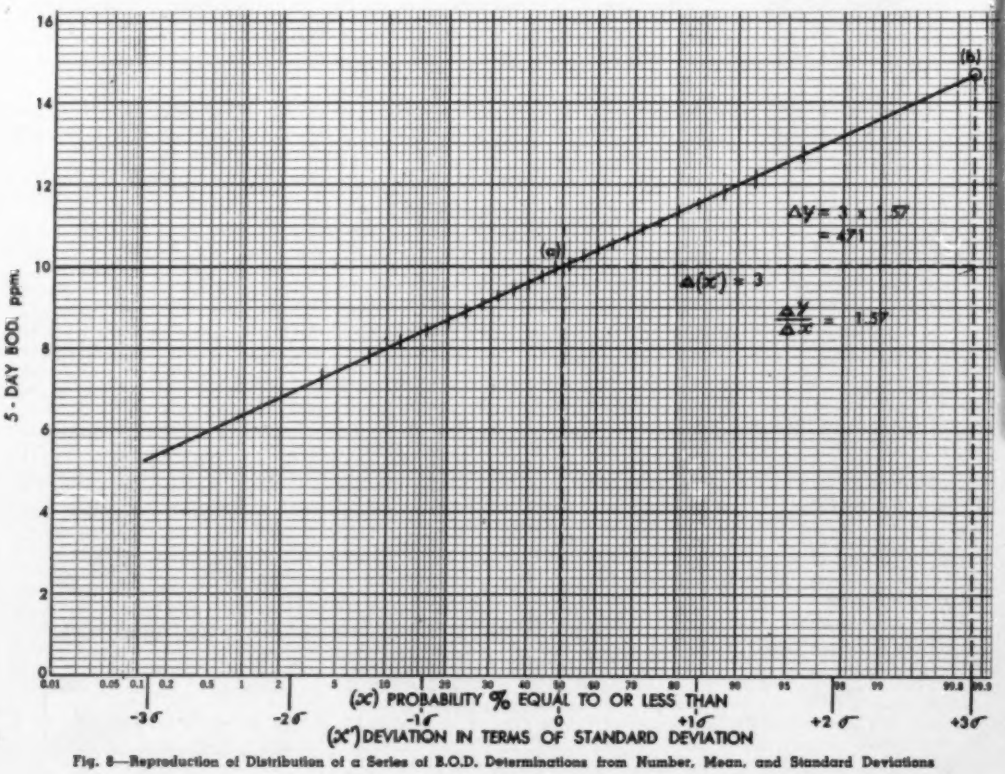


Fig. 8—Reproduction of Distribution of a Series of B.O.D. Determinations from Number, Mean, and Standard Deviations

mean located at (a) of 63.6 ppm. and a slope or standard deviation from the mean of 11.4 ppm. The probability of any range, or of not exceeding any magnitude of measurement can be read directly from the graph. For example, we expect: not more than 1 percent to exceed 90 ppm. located at (b); 1 percent less than 37.3 ppm. located at (c); and 50 percent within the range 56.0 to 71.3 ppm. about the mean between (d) and (e).

Reproducing a Series of Data

There are many occasions when we wish to reproduce graphically on probability paper a series of data from a published summary which does not tabulate each individual value. For example, if we are given the mean, the number of measurements and the standard deviation from the mean, it is a very simple operation to reconstruct on probability paper the expected normal distribution of the individual values of the series. This is just the reverse process of plotting a series of given data. For example, we are given the summary of a series of B.O.D. determinations, the number of measurements (n) 24, the mean ($\bar{Y}$) of 10.0 ppm., and the standard deviation (σ) from the mean of 1.57 ppm. The series is reproduced on Fig. 8 as follows:

Locate the mean on the Y-axis and draw a horizontal line to intersect with the vertical line, extended from 50 per cent on the X-axis at (a). This is the midpoint of our distribution. From this point lay off a slope $\Delta y/\Delta x'$ equal to the standard deviation 1.57, locating point (b). Draw a straight line from point (b) through the mean (a). This line represents the most probable distribution of the series of 24 individual measurements. If the original distribution was truly normal then the most probable values of each measurement would be located where $m/(n+1)$ or $m/(24+1)$ expressed in percent extended vertically cut the line.

With this reconstruction we now can make any interpretations concerning confidence and range or probability of not exceeding any magnitude of measurement just as though we had been given the original data.

Thus far we have realt with data that are normal, symmetrical about the central value and plot as straight lines. In the next article we shall deal with *skewed* distributions, such as selected extreme values, floods, droughts, and storm rainfall intensities.

Eliassen Receives Westinghouse Award

Dr. Rolf Eliassen, Prof. of Sanitary Engineering at Massachusetts Institute of Technology, Cambridge,

Mass., has received the George Westinghouse Award for 1950. This award is made by the American Society for Engineering Education for distinguished contributions to the teaching of engineering students.

Prior to joining the staff of M.I.T. last year, Prof. Eliassen was head of the Lewis V. Carpenter Sanitary Engineering Laboratories and Prof. of San. Engr. at New York University, a post he held for several years.

During the war Prof. Eliassen rose from Captain to Lt. Colonel in the Corp of Engineers and for a time headed the Civil Engineering Dept. of the American University at Biarritz. He has also had experience in the consulting engineering field and at one time taught at Illinois Inst. of Technology.

Cornerstone Laid at N.Y.'s Owls Head Plant

On Tuesday, May 23, New York City marked another step forward in its efforts to abate pollution of its border waters. That day, the corner stone was laid at the new Owls Head Pollution Control Project. Frederick H. Zurmuhlen, Commissioner of Public Works presided at the ceremonies. Speakers included, Robert Moses, City Construction Co-ordinator, John F. Mahoney, Health Commissioner, John Cashmore, President, Borough of Brooklyn, and the Honorable William O'Dwyer, Mayor of the City of New York. Music was provided by the Sanitation Department Band under the direction of Supt. John Celebre.

Operation of the new Owls Head plant is scheduled for 1951. It will eliminate the dumping of approximately 120 mgd. of sewage along Brooklyn's Water front. Contributing population is 1,200,000 from an area of 12,281 acres.

The cornerstone was laid in the plant's main building, the Pump and Power House. This structure will house mechanical screens, sewage pumps, grit chambers, dual fuel engines, electric generators, blowers, offices, laboratory, work shop and lunchroom.

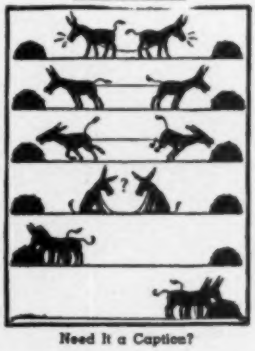
The Owls Head Project is the first plant designed to function exclusively under the high rate activated sludge process. Capacity of the plant is 160 mgd. Other features of this plant include: Enclosure and ventilation of aeration and settling tank structures, with ozonation of the exhaust air; sealed sludge digestion tanks with separate gas storage; retractable air diffusion tubes in the aeration tanks; Parshall metering flume, sludge gas utilization for power; and disposal of grit and digested sludge at sea.

Cost of the project will be $21,000,000 including the sludge vessel for barging sludge and grit to sea.

R. A. Hoot Heads Phila. Sewage Works

Announcement has been made that Ralph A. Hoot, formerly superintendent of the Ft. Wayne, Ind., Sew-

age treatment plant has been appointed superintendent of all of the sewage treatments for the city of Philadelphia. Mr. Hoot, who has published articles in *Water & Sewage Works*, is a graduate of the University of Michigan. His appointment to the position in Philadelphia was in preparation for the new Northeast Sewage Works scheduled to go into operation some time this summer.



Need It a Caption?

AWWA GENERAL SESSIONS AND MANAGEMENT DIVISION

OFFICIAL welcome by the City of Philadelphia to the AWWA Convention was given by Mayor Samuels who spoke to the first General Session of the Convention, held on Tuesday morning, May 23. Mayor Samuels called attention to the fact that this year Philadelphia is celebrating its 150th anniversary of its first water supply. Philadelphia had the first water supply in America and the first steam pump in America. Ground was broken for that supply on Mar. 1, 1799; the first brick was laid

Philadelphia Water Supply

Past	Future
E. J. Taylor	*M. G. Mansfield*
Chief	*Vice Pres.*
Bur. of Water	*Morris Knowles, Inc.*
Philadelphia, Pa.	*Pittsburgh, Pa.*

on May 2, 1799 and the water works began to function on January 27, 1801. That early supply was abandoned in 1815 for a new supply from the Schuylkill River.

Philadelphia has experienced many vicissitudes with its water supply since that time, not the least of which is a heavily polluted raw supply and severe tastes and odors. In 1945, Mayor Samuels appointed a commission to study the problem for Philadelphia. Two phases of the problem were on the agenda; the improvement of the present supply and the development of new outside sources of water. Since that time the project has moved with satisfactory developments, particularly in improving the present supply. Additions to the Queens Lane, Belmont, and Torresdale Plants have been part of the improvements. At the Belmont plant the new ozonation plant has been in operation for more than a year. Some 31 million dollars are available for the improvement project. Cleaning up the city's sewage disposal problem is a part of the program to improve the waters of the Schuylkill River.

GENERAL SESSIONS

The first general session was presided over by DR. A. P. BLACK, President of AWWA and Head of the Chemistry Dept., Univ. of Fla., Gainesville, Fla.

Philadelphia's History

"ONE HUNDRED FIFTY YEARS OF WATER WORKS HISTORY" by Elbert J. Taylor, Chief, Philadelphia Bureau of Water, Dept. of Public Works, Philadelphia, Pa.

Mr. Taylor read excerpts from old reports on the history of the Philadelphia water supply which was founded by William Penn.

In 1790 when the population was 43,000 conditions of water supply were becoming acute but it was ten years before a municipal supply was available. A report in 1798 called attention to the advantages of a new supply for culinary water, for washing the streets and for cooling the air in summer. At that time the Schuylkill River was preferred because it was cleaner than the Delaware which was subject to strong tides and filth from vessels and streets.

Mr. Taylor spoke of proposed tunnels which would bring ground water to the city and of a proposed system to bring culinary water from Spring Mills to the city. Many other proposed ideas were presented and Mr. Taylor reviewed much of the history of Philadelphia's supply since that early beginning a hundred and fifty years ago.

Philadelphia's Plans

"PHILADELPHIA'S PLANS FOR WATER SUPPLY IMPROVEMENT" by Myron G. Mansfield, Vice Pres., Morris Knowles, Inc., Pittsburgh, Pa.

Mr. Mansfield discussed briefly the amounts of water taken at present from the Delaware and from the Schuylkill Rivers and then outlined the plans which will bring the city's water supply into proper balance on the basis of 1965 conditions. He too, reviewed the work of the special commission appointed to study the problem and commented on the proposed sewage works improvements as well as improvements to the existing water plants.

Industrial Water Demands

H. E. Bacon	*S. T. Powell*
Asst. Engr.	*Pres.*
St. Powell Engrs.	*S. T. Powell Engrs.*
Baltimore, Md.	*Baltimore, Md.*

At the Belmont plant, some 1294 cu. ft. of ozone are used each day for the control of tastes and odors. Early operations of this plant brought many problems but operation now appears to have become normal. One of the byproducts of this ozonation opera-

Delaware River Plans

J. H. Allen	*Malcolm Pirnie*
Chief Engr.	*Pres.*
Incodel	*Pirnie Engrs.*
Philadelphia, Pa.	*New York City*

tion is the removal of manganese as well as tastes and odors.

At the Queens Lane Plant superchlorination and dechlorination are utilized for taste and odor control. All of the purification plants will be rehabilitated with new equipment as a part of the modernization program.

Delaware River Plans

"INCODEL'S RELATIONSHIP TO PRESENT PLANS" by James H. Allen, Chief Engineer, Interstate Commission on the Delaware River, Philadelphia, Pa.

By far, one of the most electrifying presentations of the convention made was that by Mr. Allen who both introduced and closed that part of the session which was devoted to the discussion of Development Plans for the Delaware River. In his opening remarks, Mr. Allen pointed out that the Delaware River had potentialities for furnishing 20 million persons with water. This same Delaware River has been the object of study by Incodel for a number of years and it was that Commission which proposed a detailed study and plan for further utilization of the river. As a prologue to the two speakers who followed, Mr. Allen briefly outlined the workings of Incodel which has always set an ex-

ample of how the cooperative approach to mutual problems should be made by the states involved.

"THE 1950 INTERSTATE REPORT" by Malcolm Pirnie, President, Malcolm Pirnie Engrs., New York City.

Mr. Pirnie called attention to the fact that this report on the Delaware River was the first coordinated state basis report. Plans included in the report cover not only water supply for the several metropolitan areas concerned but also stream flow control, flood control, control of salt water aggression and pollution. Mr. Pirnie summarized the status of water supplies in New York, New Jersey, Pennsylvania, and Delaware and explained how the plans for the Delaware River would help solve many

Desalting Sea Water

W. W. Aultman
Wat. Purif. Engr.
So. Cal. Wat. Dist.
La Verne, Cal.

C. H. Spaulding
Consultant
Engr. Res. Lab.
Fort Belvoir, Va.

problems of water supply in these areas.

"WHAT THE PLAN MEANS TO PENNSYLVANIA" by Francis S. Friel, Pres., Albright & Friel, Cons. Engrs., Philadelphia, Pa.

Mr. Friel showed how the areas around the Delaware River are highly industrialized and how it is necessary to maintain a minimum flow of 4000 cfs. during the summer season in order to supply all of these industries as well as some cities. When the flow goes as low as it does now, salt water backs up the Delaware River and ruins not only the water supply of many industries but production as well. Studies have been made to show the cost of this salt water intrusion to the industrial communities. For example when the salt content reaches 600 ppm., the damage amounts to $90,000 a day. The total damage in the past 12 years has been more than $9,000,000.

If flood control and flow control reservoirs are constructed as proposed, there will be sufficient water for New York City, Philadelphia, Camden, and other cities. Actually only 7 per cent of the flow would be used for water supplies. All of the reservoirs except one are to be located in N.Y. State.

"Jim" Allen Summarizes

Mr. Allen commented on the Interstate report as presented by the two previous speakers and called attention to the fact that while it was physically possible for New York City and Northern New Jersey to obtain water elsewhere, it was not economically sound to do so. The Delaware River remains the best source for all. Drought control by skimming off peak flood flows is the answer to all of these water supply problems. This is a phase of the integrated problem so often overlooked.

Mr. Allen pointed out that the U. S. Supreme Court acting on the Delaware River problem in 1931 discarded the principle of strict application of the English Common Law rule of riparian rights in favor of the principle of equitable division of waters based upon reasonable needs. That opinion concluded that "the removal of water to a different water shed obviously must be allowed at times unless states are to be deprived of the most beneficial use on formal grounds."

According to Mr. Allen, "The States of New York, New Jersey, Pennsylvania, and Delaware are proprietors of the Delaware River. These states are now joined in a cooperative and sincere effort to develop a plan which will carry out this dictum of the Supreme Court . . ." That is the course which Incodel is following. A committee of representatives of the attorneys-general of the four states is now drafting the compact to establish a "Delaware River Basin Water Commission" which will be empowered to plan, finance, construct, maintain and operate the recommended water project.

"Philadelphia and the lower river interests, can rest assured that the compact will include provisions which will adequately protect their interests. From its inception in 1936 Incodel has done everything in its power to promote the program for the best use of the precious resources of the Delaware River Basin. This will always be its aim."

Mr. Allen concluded with a few remarks about the far-reaching significance of the project in regard to the vital question of federal-state relations in the development of water resources of the country. It was these remarks which brought a resounding round of applause from the assembled audience. Mr. Allen said, ". . . in Incodel's judgment, it is a sure bet that the project will be built. The only question is: Who will do the job—and how? Incodel is convinced that the states have sufficient courage and political sagacity to recognize and meet this challenge squarely. By so doing they will go a long way toward refuting the pet theories of the centralizationists who would spread their tentacles until they eventually acquire jurisdiction over every creek and drainage area in every state in the Union.

"The Delaware River states will be put to the test in 1951, when Incodel will submit to the legislatures of the states of New York, New Jersey, Pennsylvania and Delaware, an interstate compact for the establishment of a 'Delaware River Water Commission' to build the project.

"The adoption of such a compact will constitute an invaluable contribution toward combatting a trend which,

Domestic Consumption

E. Arthur Bell
Supt.
Water Dept.
Essex Falls, N.J.

Ed. Walaszyk
Dist. Engr.
Hackensack Wat. Co.
Weehawken, N.J.

if carried to extreme, will surely lead this country into a socialistic type of government.

"Should the states fail to effectuate such a legislative program, they will not only be shirking their responsibility, but, by doing so, will be giving aid and comfort to the advocates of nationalization. If the federal government steps in and assumes exclusive control under such circumstances, the states will have no one to blame but themselves.

Mr. Allen concluded, "The proposed interstate water project is a great challenge to the Delaware Basin states. Incodel is firmly convinced the states will meet it squarely. If they do, they will set an example which could well be adopted as a fundamental principle of a sound national water policy."

The following panel discussion and two papers were reported by Harry A. Faber, Editorial Associate.

Factors in Fluoridation

One General Session was devoted to a panel discussion of water fluoridation and to two technical papers of particularly timely interest. CHAS. A. CAPEN, Chairman of the Program Committee, presided.

"THE PHILOSOPHY OF SUPPLEMENTARY TREATMENT OF PUBLIC WATER SUPPLIES IN THE INTEREST OF GROUP HEALTH" was the title of the panel discussion.

Speaking for the Committee on Fluoridation, of which he is the chairman, Dr. A. P. BLACK, Chairman, Dept. of Chemistry, Univ. of Florida, Gainesville, Fla., presented a statement for the water works industry on this subject. When the AWWA adopted and published, in 1949, its statement of recommended policy and procedure with respect to the fluoridation of public water supplies, it became the first national organization to take a definite stand on this controversial problem. This action was prompted by what is considered adequate favorable epidemiological evidence of the value of fluoridation, and the lack of unfavorable evidence.

Moderators

Bill Collection	Metering
G. E. Arnold *Director* *Water Dept.* *San Diego, Cal.*	*M. B. Cunningham* *Supt. & Engr.* *Water Dept.* *Oklahoma City, Okla.*

Dr. Black quoted the first five principles of the Code of Practice of the AWWA as bearing on the problem. He next reviewed the value, the right, and the obligation as questions which must apply to the application of supplementary treatment of public water supplies. Thus, he endeavored to prove from purely ethical considerations that society has the right to expect that those things be done which contribute to the public welfare, provided they are reasonable and practical. If the medical and dental professions believe the fluoridation of public water supplies to be in the interest of group health, then the water works industry stands ready, as it always has and always will, to participate with them in its practical realization.

DR. J. L. T. APPLETON, Dean, School of Dentistry, Univ. of Pennsylvania, Philadelphia, Pa., expressed very forcibly the urgent need for preventive treatment in respect to dental caries. Further, he emphasized that such measures would be effective only if they were not dependent on individual volition. Dr. Appleton was very undecided, however, in approving or disapproving a water fluoridation program to meet this need. He considers any present judgment to be tentative and advocates patience until a "high probability demonstration" can provide convincing results.

DR. JOSEPH SHILEN, Director, Bureau of Indus. Hygiene, State Dept. of Health, Harrisburg, Pa., said he had made a search of the literature on the subject and found that naturally or artificially fluoridated water supplies resulted in caries reduction, and that there appeared to be no ill effects when the concentration of fluoride ion was not above 2 ppm.

DR. H. T. DEAN, Director, National Institute of Dental Research, National Institutes of Health, Bethesda, Md., capably reviewed and summarized the evidence presented prior to undertaking experimental fluoridation studies now under way. In the three studies with which the National Institute of Health is cooperating, Grand Rapids, Mich., Newburg, N.Y., and Evanston, Ill., all the preliminary reports are excellent. Dr. Dean reported special studies to be under way to investigate climatological effects and the utility of cheaper fluoride compounds.

C. R. COX, Chief, Bureau of Water Supply, N. Y. State Dept. Health, Albany, N. Y., discussed the highly favorable results obtained at Newburg and noted that, as a result, his department has modified its attitude and will now approve "empirical" installations.

Process Water

"THE MAGNITUDE OF INDUSTRIAL DEMANDS FOR PROCESS WATER" by H. E. Bacon and Sheppard T. Powell, respectively Principal Assistant and Consulting Chemical Engineer of the firm of Sheppard T. Powell, Baltimore, Md.

By means of lantern slides, Mr. Powell showed that the total industrial demand for process water is one of the contributing factors to municipal water shortages. The value of industrial sales of water treatment equipment revealed the large requirements in this field; in fact, said Mr. Powell, industrial water treatment plants would be capable of supplying the water needs of large communities. When shortages are extreme, industrial process water, and wastes from municipalities and from industries, can be treated for reuse.

He classified industrial water needs as cooling water, processing water, and water appearing in products; the need for cooling water exceeds all other needs. Industrial growth is disproportionate to population growth as measured by water needs: for example, a report on the growth of Texas during approximately 50 years shows a 200 per cent increase in population but a 7000 per cent increase in water consumption.

Mr. Powell proposed a program to include a national survey of ground and surface water supplies; to study the allocation of water to industrial needs; to increase the technical personnel of the U. S. Geological Survey and expand its services; to enlarge the activities of waste control groups; to devise reasonable and equitable regulation of water supplies; and to engage in construction and long-term planning.

Desalting Sea Water

"DESALTING SEA WATER FOR DOMESTIC USE" by W. W. Aultman, Water Purif. Engr., Metropolitan Water Dist. of Southern California, La Verne, Calif.

Bill Collection Stations

W. A. La Due *Ch. Engr. & Supt.* *Bur. Wat. & Sew.* *Akron, Ohio*	*Paul Weir* *Gen. Mgr.* *Water Dept.* *Atlanta, Ga.*

Mr. Aultman noted that the recent water shortages in New York and California have again focused attention on the reclamation of sea water. The source of water is certainly ample, but the factor of cost is overlooked. He called attention to studies showing present domestic median water rates to range from 10 to 25 cents per 1,000 gal. for general consumers.

Mr. Aultman then reviewed potential methods of desalting sea water—and the costs of each. Triple effect evaporation would, apparently, be the least costly method; at least $2.60 per thousand gallons for single stage evaporation and $1.07 for triple effect evaporation. Organic anion and cation exchangers (chemical demineralization) would not only cost about $25 per thousand gallons for chemicals alone, but also 20 to 30 times the amount of water produced would be required for washing operations. Electrolytic processes for partial demineralization would cost 90 cents per thousand gallons for power alone, but also would require incredibly great (and unavailable) amounts of electric power generation.

His excellent and thorough review of desalting possibilities proves there can be no approach to present municipal water production costs (even atomic energy appears to cost more than obtaining power from coal). The publication of Mr. Aultman's paper will be awaited with interest.

MANAGEMENT DIVISION

The Management Division held four sessions during the convention. Two of these were also General Sessions.

MANAGEMENT DIVISION SESSIONS

"Recording Customer's Use and Loss of Water", by E. Arthur Bell, Sup't of Water, Essex Fells, N.J.

Multiple Dwelling Meters

H. B. Shaw
Dep. Ch. Engr.
Wash. Sub. San. Dist.
Hyattsville, Md.

J. C. Detweiler
Mgr.
Metr. Wat. Dist.
Omaha, Neb.

Mr. Bell described the recording rate of flow instrument known as the "Meter-Master" for attaching to domestic water meters, and the advantageous uses to which this instrument has been put on the Essex Fells system.

Mr. Bell said that he first learned of this valuable water loss detector in an article by Roger W. Esty in the September, 1938, issue of *Water Works & Sewage* which bears the unique caption "Putting the Water Works G-Man to Work". He vouched for the justification of Mr. Esty's appellation "the G-Man" by citing cases, one of which was the mayor's home where a loss of more than 1,000 gals. per day into the ground from a line to a greenhouse was detected by the "G-Man". He told of instances wherein, arguments over water bills had been settled through use of the "Meter Master" to convince chronic complainers. The all-convincing record charts can not be refuted.

In the end 100% of the services were checked with the "G-Man" wherein 11.3% of the water going into the customers service line was found to be lost in one or another form of leakage. Corrections saved customers money and made friends for the water department. A study of the record charts revealed meter installations which were too large or too small for the service.

In summing up Mr. Bell said that the chart records by the "Meter Master" were of value in many ways, the more important being the indication of leaks and other forms of water waste, checking meters for proper size, promoting water conservation, and improved public relations by showing the customers how to reduce his water bill by eliminating leaks and other unrealized water waste.

Roger W. Esty, Sup't at Danvers, Mass., was asked to review his early experience with the "G-Man," which he did. From the records he could say that about 32 gals. per capita per day was the proper water use in the average household.

L. W. Bausher of Akron, Ohio, told how they used the "Meter Master" in checking meters for correct size for the service.

"Water Consumption in Apartment Buildings", by Edward Walasyk, Distribution Engr., Hackensack Water Co., Weehawken, N.J.

Mr. Walasyk reported the results from a study of rates and continuity of water demands by 85 apartment buildings which had been made by the Hackensack Water Co. Thirty-five of the buildings were equipped with flush-valve water closets and fifty had flush tanks. Twenty-four hour records were obtained by use of a number of "Meter Masters" equipped with long period roll recording charts.

We regret that the tabulated data does not lend itself to reproduction here; but, as to be expected the buildings with flush valves presented short period peak demands almost twice that of those buildings with the same number of apartments equipped with flush tanks.

Using as a typical average record a 32 apartment building (64 adults and 24 children) showed hourly consumptions ranging from 1 cu. ft./min. between 5 and 6 A.M. to a peak of 71 cu. ft./min. two hours later (7 to 8 A.M.) and a second maximum demand rate from 10 to 11 A.M. of 59 cu. ft./min. The average demand per person was 59 gals./day. The maximum instantaneous demand was only 48 gpm. for the entire 32 apartments (64 adults and 24 children). The maximum demand for any 2 minutes was but 21 gpm. and for any 5 minute period only 17 gpm.

As to the rates of demand the data reveals for the 32 apartment building, considered typical, that rates above 25 gpm. existed only 1.5% of the time; 10 to 25 gpm., 40% of the time; 5 to 10 gpm. 30% of the time; 1.5 to 5 gpm. 20% of the time.

In the discussion that followed it was brought out that the demand figures observed by the Hackensack Water Co. were about one-half those given by the U.S. Bureau of Standards.

"Management Experience With Metering Multiple Dwellings" —(A Panel Discussion.—M. B. Cunningham, Moderator.)

John C. Detweiler, Supt. of Water, Omaha, Neb., presented some case records in Omaha to reveal that metering apartment buildings does not reduce water use but does have a value in influencing the building owners to have leaks repaired. The average

Los Angeles Progress

S. B. Morris
Gen. Mgr.
Dept. Wat. & Power
Los Angeles, Cal.

Chas. Haydock
Cons. Engr.
Philadelphia, Pa.

cost of water service per apartment varies between 58 cts. per month for the larger units to 40 cts. for the smaller units of 3½ rooms.

W. A. Glass, Director, Dept. of Water and Sewers, Miami, Fla., reported 100% metering of Miami's 6,000 apartment buildings. Master meters serving more than one building are permitted to single owners. Water bills are considered a negligible part of maintenance costs.

B. E. Payne, Sup't and Chief Engr., Louisville, Ky., Water Works, reported Louisville 100% metered and rarely is more than one building served by a single meter. Monthly billing of apartment buildings changed to bi-monthly, with only 3 out of 200 apartment house owners objecting to the longer billing period. Individual meters to each apartment being impracticable some building owners have charged tenants with air conditioning installations a nominal water rental because of extra water used.

Harry B. Shaw, Deputy Chief Engr., Washington Suburban Sanitary Distr., Hyattsville, Md., reported that owners of 17 apartment buildings had the following to say: Did not pass on water charges to tenants; did not believe them wasteful of water; none had any methods for preventing

water waste by tenants. Average consumption per apartment is 760 cu. ft./month. The per capita use per day for apartment dwellers is 69 to 77 gals. which compares with 80 gal./capita/day for the entire District. For individual residences the per capita figure is but 47.5 gals.

G. J. Van Dorp, Water Commissioner, Toledo, Ohio, said that multiple metering of apartment buildings is permissible. Metering of individual apartments would be impracticable. One reason is that the bills would be the minimum charge in all but rare instances.

Wm. G. Banks, Division Engr., Bureau of Water, Newark, N.J., reported 100% metering with meters the

Water Authorities
F. S. Friel
Pres.
Albright & Friel
Philadelphia, Pa.

Fluoridation
A. P. Black
Head
Dept. Chem.
Univ. of Fla.
Gainesville, Fla.

property of the water user. Each apartment building required to install a separate meter. Billing is monthly. Water Dep't supplies inspection service which apartment owner can have upon request.

Mr. Worth, Commissioner, Washington Suburban Sanitary District, stated that the sliding scale rate to apartment house owners had to be abandoned because water was being sold at less than cost under present production costs. Apartment dwellers use about 1.5 times the water used per capita in private homes.

Water Authorities

"Pennsylvania's Experience With Water Authorities", by Francis S. Friel, Consulting Engr., Philadelphia.

Under Pennsylvania law Water Authorities can be established as a separate governmental entity in the nature of a Sanitary District. To date 42 of these Authorities have been established to take over municipally owned plants, but more prevalently to purchase and operate privately owned water systems. These Authorities are given broad powers and their power of borrowing money is not curtailed by the legal limit of municipal debt.

Mr. Friel reviewed the success of the Penna. Water Authorities for the following reasons: Surplus earnings can not be captured by the municipality served. They pay no taxes, whereas municipalities are forced to pay for fire protection provided, as was the case when the system was privately owned. Rates are fixed on a realistic basis. Employees are better paid than in municipal operation, probably because such was the case when the property was privately owned. Even so, operating costs are lower per capita than those for the country at large.

Mr. Friel said that the few disadvantages included the ¼% higher interest rates on bonds. All debt must be retired in 40 years and the property turned over to the municipality after 50 years. All in all the Penna. Water Authorities enjoy good management and are prospering with little if any rate increases since their establishment.

"Long Range Water Supply Management, as a Factor in Los Angeles Progress", by Sam B. Morris, Gen'l Mgr. and Chief Engr., Dept. of Water & Power, Los Angeles, Calif.

In a most interesting paper Mr. Morris recounted the importance of water supply to Los Angeles and the history of the municipality from 1781 to date. For 30 years the system was privately owned until purchased by the city in 1902 with the famed Wm. Mulholland as its bold and farsighted chief engineers. He conceived the Colorado River development as far back as 1905 and pushed it through on the admonition "If you don't build it you won't need it"—another way of saying that without ample water Southern California would be a "dead duck".

Now with 10,000 employees, the Los Angeles Dept. of Water and Power operates as a $75,000,000 private enterprise but as a Civil Service organization. Stressing the importance of metering, which started in 1902 under much objection and became 100% metered in 1906, Mr. Morris pointed out that equitable distribution and the elimination of wasteful practices merely meant that the same quantity of water could support a materially greater population leading up to the latest increase to put Los Angeles in 3rd place amongst the most important American cities. That is what water meant to one community which had nothing but determination and a desert on which to build and expand.

Mr. Morris stated that the Department is now financed through Revenue Bonds entirely, $69,000,000 having been sold since World War II. The Department contributes an annual "dividend" into the city's General Fund in the amount of 5% of gross receipts.

Mr. Morris ended with a note on the Colorado River water and what it would mean to Los Angeles in the day of need, and to 27 other municipalities, in contrast to its value to Arizona for irrigation projects of doubtful financial soundness. It is on these grounds that the Colorado River Assn. has been again energized to fight the so-called Arizona Water Steal.

Fire Protection

L. E. Ayers
Ayers, Lewis, Norris & May
Ann Arbor, Mich.

R. H. Ellis
Hyd. Engr.
Fact. Mutual
Boston, Mass.

Development of Nation's Water Resources

"How Can the Nation's Water Resources be Developed in an Orderly Fashion?" by Dr. Gilbert F. White, President, Haverford College, Pa.

Dr. White, a member of President Truman's Special Committee on a National Water Policy, outlined the reasons for the appointment of the temporary committee on water development and use as the first move toward solving the national problem of water supply which had come into the days of adversity and confusion. A policy to be followed is illy defined to now and, therefore, a review is now under way. He praised the work of Abel Wolman and his A.W.W.A. committee on National Water Policy now being extended and amplified to cover all water uses through the Water Panel of the Engrs. Joint Council and a special Coordinating Committee chairmanned by Abel Wolman.

(Ed. Note: The report of the E.J.C. Water Panel issued on July 1, and was made available to the President's Committee on a National Water Policy. The report is reviewed elsewhere in this issue.)

Dr. White stated that scattered and inefficient operation and management at the Federal level and collisions between the Corps of Engineers and the Bureau of Reclamation and duplica-

tion of work leads to the belief in many quarters that a strong National agency be developed to clear up the confusion and waste. As the result of such confusion the Hoover Report recommends strengthening state participation in water matters and the establishment of a new National Water Development Service and Department.

There are apparently two choices for improvement: (1) Administrative Reorganization. (2) Expansion of Valley Authorities. The tendency is to resort to the Valley Authority as the easiest method, but in Dr. White's opinion the Valley Authority is the second choice and the Hoover Committee recommendation should be

Water Rates

Thos. L. Amiss
Supt.
Wat. & Sew. Dept.
Shreveport, La.

C. H. Capen
Chief Engr.
N. Jer. Wat. Dist.
Wanaque, N.J.

explored. Also such organizations as Incodel and the Ohio River Commission in solving interstate problems should be vigorously supported.

Dr. White closed by saying that too few water works men are taking part in advance planning which involve interstate projects and multiple purpose projects.

Private Fire Protection Charges

"A Survey of Charges for Private Fire Protection" by Richard H. Ellis, Engineer, Factory Mutual Fire Ins. Cos., Boston, Mass.

Mr. Ellis reported the results of a survey made to determine methods and rates charged for private fire protection service by water utilities. Most of the data came from questionnaires to 1500 water utilities and covers 1269 different water utilities. The most prominent fact disclosed is the lack of uniformity among water utilities concerning requirements, rates and methods of charging for private fire protection service.

Concerning meters on fire protection service lines less than 30% require meters of the detector check or fire service type. In Canada less than 15%.

Concerning fire service (standby) charges by municipal plants only 44% now levy such charges where no water is used through the connection except for fire. In Canada only 35%. In the case of privately owned plants only 9% levy no charge.

Concerning the range of charges 56% of the municipal plants charge less than $50.00 per year for a 6 in. line; 26% charge between $50 and $100. In the case of private plants only 16% charge less than $50 and 61% charge between $50 and $200 per year for a 6 in. connection. One private plant charges $960 per year, the highest municipal charge being one plant at $500 per year. Thus, the great lack of uniformity in making charges for equivalent service stands out sharply.

In the matter of charges for sprinkler systems the charge varies between 1 and 10 cts. per year per sprinkler head. However the newer rate schedules call for 20 cts. per year per sprinkler head, and a few charge more. Here again the lack of uniformity in rates is conspicuous.

Concerning the basis for making the annual charges, again there is lack of uniformity. In the U.S. 45% levy on the basis of size of connection to the main; in Canada only 22%. Some charge on basis of number of fire hydrants on the property and a large number combine size of connection, number of hydrants, number of elevated tanks and number of sprinkler heads. In Canada 22% have charges on number of sprinkler heads alone.

Concerning installation cost of the service to the property line only 3% of the municipal plants in the U.S. and Canada make no charge for the installation. Private company practice is that 20% of the water utilities stand the full cost and 18% pay a good part of the cost.

Mr. Ellis made a realistic analysis of the existing situation wherein properties protected by sprinkler systems are charged twice for fire service when a levy is made based on the number of sprinkler heads. He presented evidence to support his contention that sprinkler systems actually reduce water demand in a fire and consequently can not be justifiably charged for on the basis of readiness to serve. It was his contention that fire protection is rightfully a tax charge against the property enjoying the protection. Therefore, the only equitable method of financing fire protection is through the channels of tax assessment based on the value of the property protected. In turn the municipality should pay to the water utility the full cost of providing fire protection on a city wide basis. In turn the rates for metered water can then be reduced and the water user freed of paying for fire protection in the ratio of water used rather than protection on the just basis of value of property enjoying the protection.

Water Rates

Progress Report of the Committee on Water Rates—A Panel Discussion by members of the Committee—Chairman L. E. Ayres, Moderator.

Before calling on members of his committee comprising the Panel on Water Rates, Chairman Ayres commented on the hit or miss character of water rates now in force over the country, as revealed in a survey. In

Water Rates

A. P. Learned
Prin. Engr.
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Kansas City, Mo.

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Pres.
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many places rates were such as to provide income for the General Fund of the municipality. In others the reverse was the case. There appeared to be two corrections for these conditions: (1) State Utility Commission supervision of water rates charged by publicly owned systems, such as exists now in Wisconsin, West Va., Wyoming, Montana and Nevada. (And, also in Maine—Ed.) (2) Operation of the Water Utility by a Board or Commission independently from the city administration.

Basically all utility rate structures should represent a combination of a "service charge" which covers the cost of maintenance, operation, billing, etc., and a "commodity rate" on the volume of water used by the customer. Actually, the service charge represents 85% of the total costs of water supply service and the commodity charge about 15%. The argument against this basically correct method of charging is that too much load is thrown on the smallest users, usually the least able to pay consumers who use less than the allowed volume of water covered by the minimum charge for metered service.

Hal. F. Smith, Sr. Administrative Ass't, Dept. of Water, Detroit, had an exhibit consisting of a comparison of including the "readiness-to-serve"

charge in the consumption charge as against including it in the "service charge" for Detroit conditions. The comparison revealed that the smaller consumers would be paying something more than four times as much under the second method as under the first.

CHAS. A. CAPEN, Chief Engr., No. Jersey Water Supply Comm., Wanaque, N.J., was against a "service charge" and for the "minimum charge" on the basis of allowing only 100 gals./day per meter for the minimum charge. He felt that water piping systems should be amortized at a 1% rate per year and bonds for extensions and improvements issued at 5 yr. intervals. Municipal utilities

Committee Reports

Annual Reports
M. P. Hatcher
Director
Water Dept.
Kansas City, Mo.

Air Conditioning
F. C. Amsbary
Vice Pres.
Ill. Wat. Serv. Co.
Champaign, Ill.

should pay taxes and should be paid for fire service and all water supplied city properties. In turn the water utility should earn a sufficient income to declare a nominal "dividend" to the General Fund and be allowed to hold ample profits to keep the system in first class order and pay employees adequately. Until this objective is attained no rate schedule is adequate or sound.

NATHAN B. JACOBS, President, Morris Knowles Inc., Pittsburgh, Pa., was of the opinion that the only basis for rates was that of obtaining a sound return on the investment plus whatever surplus could be justified. Rates must be considered from the customer's point of view, which includes consideration of the value of water service and fire protection to the various types of customers.

THOMAS L. AMISS, Supt. and Engr., Dept. of Water and Sewage, Shreveport, La., spoke as one who had been for many years connected with private water works management before becoming manager of the municipally owned Shreveport system. His theme was that a water utility should earn a fair return regardless of its status or type of management. Municipal utilities would do well to study rate structures of privately owned utilities in developing rate patterns. Fire protection costs in Mr. Amiss' opinion receive too much emphasis in cities of less than 500,000. He felt that A.W.W.A. should start from scratch and develop the real facts concerning fire protection costs and how they should be financed.

Based on long years of experience, Mr. Amiss warned against trying for the "perfect rate structure" and against breaking down operations and cost of facilities into too many categories or classifications. He thinks the "service charge" an honest term which can be sold to the customers accustomed to the "minimum charge." The "readiness-to-serve" charge or the "demand charge" are too difficult to explain. The "service charge" should not include any of the general overhead costs but should be sufficient to pay the cost of the meter and service in a 20 year period plus the cost of removing, testing and renovation of the meter three times in this period. Possibly something for fire protection service should also go into the flat service charge. All other costs of supplying water service should go into the "commodity charge." The graduated "service charge" will permit the customer to select the size of meter and service he desires since he will be paying for whatever he selects without argument and dissatisfaction.

Mr. Amiss pointed out that the small domestic customers already pay more than their fair share in most instances. In Shreveport only 26.4% of the total distribution is domestic consumption but this classification pays 48.2% of the total revenue. Commercial accounts take 36% of production and contribute only 27% of the total revenue. Industrial accounts take 37.6% of production and contribute only 24% of the total revenue. By all reasonable considerations the picture should be reversed and possibly the "service charge" is the needed corrective. Under the present system the small (domestic) user is absorbing the costs for fire protection in many instances. As to the "commodity charge" this should be developed on a simplified rate structure applying equitably to all classes of customers in as few rate steps as possible—five being the maximum, and fewer if permissible.

Demand Rate & Distance Factors

"EXPERIENCE WITH DEMAND AND DISTANCE FACTORS IN RATE MAKING" by M. P. Hatcher, Director of Water Dep't, Kansas City, Mo.

Mr. Hatcher introduced a new conception in rate making which has been applied by Kansas City, Mo., for two years with apparent success. The rates to distant customers might be termed "zone rates" which take into account the added cost of water delivery beyond a given mileage of main from the pumping stations and also the peak rate of draft such as golf courses demand during sprinkling periods. The net result is that the "peak demand rate" is high enough to encourage customers in this category to build elevated tanks or provide other storage facilities which are filled during off-peak hours.

In any rate structure Mr. Hatcher proposes a combination of interest and depreciation charges on plant as the demand or service charge, and constituting 25% of the total rate, plus

Air Conditioning

E. L. Bean
Prin. Asst. Engr.
Bur. of Water
Philadelphia

M. C. Smith
Chief Engr.
Dept. of Pub. Util.
Richmond, Va.

the commodity charge based on all costs of operation and maintenance, comprising 75% of the total rate.

In making rates to suburban customers, Mr. Hatcher advocates charging something for the main facilities already existing between the pumping station and the boundaries of the city. Such is done in Kansas City, but Mr. Hatcher pointed out that Milwaukee had earlier applied to the Public Service Comm. of Wisconsin for a rate to outside industries taking into account the length of main but had been refused. In Kansas City, though, the method had been accepted by the distant customers as a fair rate.

The final session of the convention was devoted to the Management Division with the presentation of two committee reports and a paper.

Annual Report

"ANNUAL REPORT OF WATER DEPARTMENTS"—Committee Report by Chairman M. P. Hatcher, Director, Water Dept., Kansas City, Mo.

The chairman reviewed the history of the committee's work from its appointment in 1946 to the present report which it considers as final. The Committee believes that the annual report has come into its own in recent years. In the water work field, some privately owned companies have kept

A. P. Black Shakes the Hand of Incoming "Vic" Weir

A President's Last Duties

Helen Rotthaus, Fuller Awardee, Accepts Hill & Henshaw Cups for Arizona Section and Congratulations for Herself

pace with progress in reports to stockholders. Publicly-owned properties have not matched the progress shown in the corporate and general municipal fields but have profited by examples in other fields.

The Committee believes that industry can profit from some reorientation of thinking on annual reports aimed at correction of certain present shortcomings. Present reports seem to attempt to reach two groups of readers having different interests. Professional personnel are served quite well but non-professional readers are lost in a maze of data tables and technical diagrams.

The Committee proposes that the two-fold purpose of annual reports be served by a two-part annual report. One part to be printed in narrative style with illustrations pertinent to the subject matter. The other part to be a less formal document, possibly mimeographed, to include the statistical data necessary to picture the operation of the property. The printed report would be distributed mainly among business and civic leaders in the community and would serve as an instrument to further good public relations. The statistical report would be the property management's own historical record of operations and would be distributed to managers of other water works properties and to consulting engineers and others interested in the detailed results of operations.

In making this recommendation, the Committee realized that the present single report has many advantages and might be desirable if only to maintain continuity of history in like form. In its study of the subject the committee surveyed the interest in the annual report field, and it discussed in detail the two part report, the printed report and the statistical report and it presented a guide to the preparation of an annual statistical summary of the operations of a water works property.

Service for Special Customers

"What Does It Cost to Provide Service to Special Class Customers" by Elwood L. Bean, Prin. Asst. Engr., Bur. of Water, Philadelphia, Pa.

Mr. Bean opened his paper by calling attention to the difference in attitude in the past 20 years. Two decades ago water departments were encouraging the sale of water; now many of them do not have enough water to supply customers. A part of this deficiency had been due to population growth but most of the increased demand has come from industry, i.e. a special class of customers.

Mr. Bean reviewed industries' demands, normal water use, mean increases in consumption in several large cities, consumption ratios versus pressures, summer maximum demands, load factors of refrigeration use, and the growth of refrigeration uses.

The latter part of the paper was devoted to problems of increasing supply to meet demand, the cost of financing, the economics of water supply and its application to consumers, expansion problems, and a determination of what is considered to be proper income. Mr. Bean closed his presentation with the statement that "where use trend indicates the approaching necessity for new supply facilities, or major expansions or enlargements, conservation should be enforced to postpone such necessity. This is emphasized by the fact that rising costs for such construction necessitate major increases in the unit cost of furnishing water."

Air Conditioning

"Water Use for Air Conditioning"—Committee Report by Committee Chairman Frank C. Amsbary, Vice Pres. & Secy., Illinois Water Service Co., Champaign, Ill.

This report was introduced by a review of the objectives which the committee had set in its first report made in May, 1949. The committee's study is being confined to two classes of water systems: Those for which the present water supply is inadequate or approaches inadequacy; and those for which the source of water supply is presently adequate and where adequacy will not become a problem at some future date but where physical plant facilities will be jeopardized if air conditioning or other refrigeration uses are not controlled.

In the first instance immediate restriction is the only answer. In the second case restrictions are not advocated but elimination of waste indicates the need for conservation practices before demands on the physical plant exceed capacity.

The committee has continued to work with the air conditioning and refrigeration industry in its approach to solving the problems presented by this rapidly growing demand for water. The committee feels that the answer in part lies in the establishment of demand charges. While there is a difference of opinion as to the basis for a demand charge, the committee is searching for a demand meter that can be economically purchased, operated and maintained. This problem has not been solved. The committee has also considered a special rate for air conditioning. Included in the report was a model ordinance for the regulation of installation and operation of air conditioning equipment. This model ordinance is presented not as a final form but as a guide for the development of the ideas which must go into actual ordinances which will vary from city to city as the situation demands.

Following the presentation of the committee report, Mr. Amsbary and Mr. Bean were joined by L. L. Lewis, Vice Pres., Carrier Corp., Syracuse, N. Y., and by Marsden C. Smith, Chief Engineer, Dept. of Public Utilities, Richmond, Va. These four participated in an open discussion of the subject of air conditioning.

WATER TREATING EXPERIENCES

Handling Soft Lake Water at Fort Smith, Ark.

The Fourth of a Series of Articles.

by

A. H. ULLRICH

Superintendent Water and Sewage Treatment
AUSTIN, TEXAS

AS noted in the third article of this series (May 1950), the raw Lake Fort Smith water is very soft, low in alkalinity, low in dissolved solids and has a low pH value. At times it carries small concentrations of iron and manganese. Usually the raw water turbidity is low but turbidities up to 1,600 ppm. have been encountered. Such turbidities as are obtained are fine and colloidal in nature. During summer months the warm upper level water is normally very clear but is then high in algae growths with their attending tastes and odors. The cool lower level water seldom has turbidities much below 10 ppm. but it is, as a rule, almost totally free from algae growths. During and after heavy rains the coliform index may be quite high but usually the total bacteria count remains low. Frequently, during summer months, the raw lake water will meet the U. S. Public Health Standards for drinking water, insofar as the coliform index is concerned.

Because of the known purity of the clear creek water, which was impounded to form Lake Fort Smith, it was not anticipated that we would have much difficulty in the actual treating of the lake water, or in making it into an ideal domestic and industrial water. Consequently the project was sold to the public on the basis that they would have "just about the best water in the world" and that much money would be saved in chemical treatment. Consequently, also, it was anticipated that the water would require only simple coagulation with alum and lime, followed by settling and filtration; chlorine or chloramine treatment for disinfection; and occasional treatment with carbon for taste and odor control.

Experiences in Coagulating Soft Water

When we started the new plant we soon learned that the optimum pH for coagulation with alum was in the neighborhood of 6.3 and that, unlike the medium hard Poteau River water, which we had previously treated, the soft lake water possessed no buffering value. Even slight deviations up or down from the optimum pH caused rapid floc deterioration unless larger than optimum alum dosages were used. However, since no provision had been made for pH adjustment in the filtered water we decided to coagulate at pH 7.0 to 7.1 and hope for the best until further studies could be made. The best was not very good because we soon received numerous red water complaints. While the public was pleased with the soft, excellent tasting water it was difficult to explain why "the best water in the world" should be red (or rusty) entirely too frequently.

The Author

Having heard the author speak on various occasions, the editors realized how well qualified he is to present to the readers of *Water and Sewage Works* this series of articles discussing some of his varied experiences in treating waters of vastly different characteristics. Other articles in the series which will deal with treating turbid and hard waters are to follow.

Ferric Coagulants Tried

Since coagulation of the lake water with alum at pH 7.0 to 7.1 gave poor floc formation at its best and still failed to alleviate corrosion and red water complaints, we immediately started experiments in the use of "Chlorinated Copperas."* At that time it was our desire to find a coagulant which would have an optimum, or near optimum, coagulation range near the pH which we wanted in our treated water. The advantage would be that it would then not be necessary to use a split lime treatment for coagulation and for pH control. Our experiments with chlorinated copperas gave promising results when coagulating at pH 9.0 or higher. However, our equipment for chlorinating the copperas was rather inefficient so that its use was troublesome and messy. We were, therefore, pleased when we learned that Monsanto Chemical Co. had developed a stable anhydrous ferric sulphate ("Ferrisul"), with which we started experiments as soon as a supply could be obtained.

The experiments were started early in 1937 and by the end of the year we had standardized on its use. Since calcium carbonate stability tests showed the water to be stable at a pH of about 8.9 to 9.0 we started coagulation with ferric sulphate at pH values slightly above 9.0. It is interesting to note that when this higher pH water first reached the distribution system there was a general sloughing off of accumulated rust, tuberculation, etc., so that red and rusty water complaints reached a peak. Fortunately this sloughing off period lasted only from 24 to 48 hours and progressed across town as in a wave. After that we had very few complaints as regards red water from the cold water taps.

While we had apparently reduced aggressive corrosion of the water in our distribution system, we were still receiving complaints of rusty water from galvanized tank type hot water heaters. By early 1938 we were receiving complaints of failures of heaters of this type. This was at first disturbing because, according to accepted stability tests, we were definitely treating the water so that it should form a protective coating of calcium carbonate. Finally we realized that the water did not contain sufficient calcium nor carbonate to permit any appreciable calcium carbonate deposition. Even if the tests showed that it would not dissolve calcium carbonate and should actually deposit some, deposition of perhaps "one molecule per gallon" would again render it unstable. At about this time we also came to the realization that the

(*Ferrous Sulphate (copperas) oxidized to the ferric state with chlorine.)

white material which we were finding in galvanized piping was not deposited calcium carbonate, as we had thought, but actually a powdery form of zinc oxide or hydroxide. In other words, we were actually removing the galvanizing zinc from galvanized surfaces. Subsequent studies indicated that pH values of this water in excess of 8.8 would definitely attack zinc, but that lower pH values were not detrimental. Our treatment was then immediately adjusted so that the finished water pH ranged from 8.5 to 8.8. It might be noted here that it was very difficult to maintain an exact predetermined pH in the finished water, because the water had no buffering quality. For example, a total alkalinity of 17 ppm might give a water having a pH of 8.5 while a total alkalinity of 18 ppm. (1.0 ppm higher) might give a water having a pH of 8.7. Obviously with volumetric type lime and iron feed machines it was difficult to maintain sufficiently uniform dosages to permit maintenance of such exact pH values.

Late in 1939 we learned that the Tennessee Corporation had developed a new hydrous ferric sulphate. We used it on an experimental basis in 1940 and obtained good results with it. We found that the Monsanto Chemical Company's anhydrous "Ferrisul" and the Tennessee Corporation's "Ferri-Floc" gave about equal results when compared on an iron content basis. At about this time we also conducted exhaustive two gallon jar tests to determine the optimum pH ranges for alum and ferric sulphate coagulation of the soft lake water. These tests confirmed previous data showing the optimum pH for alum to be 6.3 and also showed that deviations as small as 0.1 pH value often caused marked deterioration in floc formations. In contrast, the optimum pH range for ferric sulfate coagulation was found to be from 5.8 to 6.8 with but little difference in quality of floc formation within these limits. Also of interest was the fact that after the iron floc was completely formed we could immediately increase the pH to 8.5 or higher without adversely affecting the floc or its settling characteristics. Since coagulation of the ferric sulphate at low pH values seemed to give a more sparkling water as well as permit a lower dosage we subsequently standardized on a treatment in which the water was coagulated at or near pH 6.3 and a second dose of lime was added at the end of the flocculator to raise the pH to about 8.6. This method of coagulation was continued until late 1947 when the author left Fort Smith to take his present position in Austin.

Chlorination and Ammoniation

The excellent results which we had obtained with pre-chloramine treatment of the raw Poteau River water led us to standardize on the same type treatment at the new Lake Fort Smith Plant. The lake water had a low chlorine and chloramine demand but at about this time it was thought to be good practice to maintain rather high residuals throughout the distribution system. Therefore, when the plant was first started we maintained residuals of 0.5 ppm or more throughout most of the system. This was continued until we found that although pH adjustment had eliminated practically all cold water red water complaints we still had a few troublesome dead end areas and had one troublesome neighborhood where an old cast iron main, which had been taken up and cleaned, had been relaid as a new feeder main. A series of samples were collected from this neighborhood and from other sections of the distribution system. These were tested for dissolved iron and chlorine residual. It was found that when there was appreciable dissolved iron there was little or no chlorine residual and when there was a high chlorine residual (as during high flows) there was little or no dissolved iron. While these results were not considered conclusive evidence of increased corrosion due to a high chlorine residual we decided to reduce the chloramine dosage. It is an interesting fact that dissolved iron disappeared from the water in the troublesome area within a few days after the chloramine dosage was reduced and complaints from dead end areas were also sharply reduced. Later we standardized on a treatment which gave us a chloramine residual ranging from 0.35 ppm. to 0.45 ppm. in the plant effluent. Since the water had to flow through approximately twenty-three miles of pipe line before reaching town there was usually little residual left in the distribution system.

At the Fort Smith Plant, where ammonia and chlorine (1 to 4 ratio) were added to the raw water in dosages sufficient to carry residuals throughout the plant and still have from 0.35 to 0.45 ppm residual in the filter effluent, this effluent was consistently sterile as shown both by the coliform test and the total count. Plants treating waters which require higher chlorine or chloramine residuals in order to maintain consistently safe effluents must generally, of course, carry higher residuals into the distribution system unless they practice dechlorination.

Value of Residual in Distribution System for Health Protection Is Questionable

The author has come to believe, however, that if a given treatment consistently gives a safe effluent, the value of carrying additional residual for the distribution system may be open to question. Contaminated water from cross-connections and back siphonage usually travels in "slugs" and the contamination so obtained will likely be too severe for any practicable residual in the mains. Residuals carried in the distribution system as a protection against secondary contamination would then seem to serve more to give us a false sense of security rather than dependable protection.

Experiment with "Calgon" and "Micromet"

After adjusting the treated water pH to the range of 8.5 to 8.8 and reducing the chlorine residual we received very few complaints of red water in the cold water but we continued to receive complaints of hot red water and galvanized tank hot water heater failures. These complaints were confined mostly to the fall, winter and spring months when the dissolved oxygen content of the water was 6.5 ppm or higher. We could predict an increase in the number of such complaints almost to a day by watching the results of our routine dissolved oxygen tests. When the D.O. was less than 6.5 ppm, there were few complaints but above 6.5 ppm the complaints began to increase.

Since we were receiving no complaints from owners of copper coil type heaters or monel metal tank type heaters, we began to suspect that galvanized tank type heaters were simply not suited for use with a soft, high dissolved oxygen content water. To confirm our suspicion we obtained a galvanized tank heater of reputable manufacture which had been in service approximately eighteen months and which was just beginning to give red water. This heater was taken to the shop, dismantled and cut into halves. Our inspection showed that the galvanizing had been completely removed in spots the size of a dime all over the inside surface and that where the galvanizing had not been removed the remaining coat was very thin. We also noted that the heater contained four dissimilar metals, namely; a steel tank, galvanizing (zinc), a tin cold water down pipe and a brass thermostat. By filling half of the tank with water and suspending the tin downpipe in it, we found some six milliamperes of current flowing between the down pipe and the heater

shell. In other words, galvanic action within the heater itself was causing its failure.

From the above studies and from our previous satisfactory experience with medium hard Poteau River water, we concluded that the successful use of galvanized tank type hot water heaters depends on the use of a water which will deposit a protective scale or a water which is artificially treated to lay down a protective coating. Since the addition of sufficient carbonate hardness was out of the question, both because of the cost involved and because our consumers were by then delighted with the soft water, we decided to try sodium hexametaphosphate (Calgon) early in 1942. At that time we were advised that a 2.0 to 3.0 ppm dosage for several weeks followed by a 1.0 ppm continued dosage would suffice to protect hot water heaters. The recommended dosages were tried over a period of four months with no noticeable relief in consumer complaints. Later in 1942 we experimented with "Micromet"—also a complex phosphate. This material was fed, as recommended, directly into the cold water lines of the hot water heaters under test. The results obtained were excellent and, while the cost of the "Micromet" was high, it was felt that many consumers would want to use it because the then war time restrictions made heater replacement difficult. Because we did not wish to advertise a patented and trademarked material and in order to build up better relations with the plumbers, we decided to introduce its use through the plumbing trade. Consequently, we called a meeting of all plumbers and wholesale plumbing suppliers to advise them of our findings and instruct them in the use of "Micromet." Thereafter, its use spread rapidly and consumer complaints decreased proportionately.

Apparently the actual dosage of "Micromet" obtained through the use of the originally recommended solution—pot type of feeder—was in the range of 5.0 to 10.0 ppm. It is interesting to note that the manufacturers of sodium hexametaphosphate later began to recommend dosages varying from 5.0 ppm to 8.0 ppm or higher for protection of tank type hot water heaters and hot water systems where the use of soft water was involved—the exact dosage recommended depending on the analysis of the water. Obviously, the cost of treating an entire municipal supply with such high dosages would normally be prohibitive.

Taste and Odor Control

During the first few summers that the Lake Fort Smith Plant was in operation, the raw lake water often carried high algae concentrations with attending objectionable tastes and odors. Fortunately, the tastes and odors were always of such nature that they could be removed with relatively low dosages of activated carbon. The maximum dose required seldom exceeded ten pounds per million gallons. The general practice was to feed carbon into the raw water in the flash-mix chamber just behind the chlorine, ammonia, ferric sulphate and lime. It was our experience that when fed at this point it never interfered with the action of the chloramine and did not reduce the chloramine residual. Later it became our belief that the chloramine somehow actually aided the efficiency of the carbon. Whether it was the fact that the carbon was in contact with low pH water throughout the 30 to 40 minute detention time in the flocculator before the pH was adjusted upward or whether it was the combination of chloramine with carbon that made for such good results is not known. At any rate, removal of the tastes and odors was never a troublesome problem with the combination of chloramine and activated carbon treatment.

In this connection, it might be of interest to note that after many attempts at using the then recommended threshhold odor test, for determining the proper carbon dosage, we abandoned it in favor of simply noting the presence or extent of odors obtained when washing a filter. It was found that the turbulence and aeration given the wash water as it fell into the wash water gullet was sufficient to release noticeable concentrations of odors before these had reached concentrations sufficient to be noticeable or objectionable in the drinking water. After we learned that this was true for our particular water the operators were instructed to use it as a simple but dependable test and guide for determining the carbon dosage requirement.

As previously noted, after the first few seasons that the new plant was in operation, we learned that the lower lake level waters seldom carried algae and that we could generally escape them by changing to lower water during algae seasons. Thereafter we avoided treating the upper water during the summer months, chiefly to escape algae flocs which carried onto the filters and caused poor filter operation. This also reduced the algae tastes and odors to the point where use of carbon was seldom necessary.

In the next article of this series the author will relate his experience in softening the relatively hard Colorado River water at Austin, Texas.

Homer Jorgensen Establishes Consulting Office

Homer W. Jorgensen resigned from his position as Design Engineer, Los Angeles County Sanitation Districts, July 1st in order to establish his own practice as consultant in sewage treatment and industrial waste disposal. He will locate his office at some point in the San Joaquin Valley, where he formerly was District Engineer for the State Health Dept. of California before entering the service in World War II.

Mr. Jorgensen, a "native son," was born in San Diego, Calif. In 1935 he received the degree of B.S. in Sanitary Engineering from the Univ. of California. In World War II he served with the U.S. Engineers and the Sanitary Corps as Captain in Charge of a Malaria Control Unit in the Philippines.

Since demobilization he has served as Design Engineer with the Los Angeles Sanitation Districts under A. M. Rawn, Chief Engr. and Genl. Mgr. Active in association work, he is Secretary of the Los Angeles Section of A.S.C.E. and Editor of the Journal of the California Sewage Works Association.

Harry Jordan Honored by ASA

Harry E. Jordan, Executive Secretary, American Water Works Assn. has been awarded an honorary certificate by the American Standards Assn. in recognition of his work in the development of industrial standards. Mr. Jordan has been a member of the ASA Standards Council for the past eleven years, representing the AWWA, which is one of the 101 national technical societies and trade associations that work together in ASA.

Intake Tower Red Hills Lake, Madras Supply
Feeds Old and New Aqueducts to Kilpauk Plant.

Dr. P. V. Cherian
Mayor

C. Narasimham
Commissioner

IMPROVEMENTS TO THE WATER WORKS OF MADRAS

Excerpts from a brochure describing the City Water Works of Madras, India, its modernization and recently completed and projected improvements— Courtesy of M. Munisami Achari, Chief Water Works Engineer.

THE City of Madras, India, as with many other of the World's cities, has found it necessary to expand its water supply system to meet population growth and to provide better service. The city's water works originally completed in 1914 were augmented in 1944 by construction of a new enlarged reservoir, the "Satyamurthi Sagar" at Poondi, first of a series of planned improvements in the source of supply, head works and distribution.

Next came construction of a Second Conduit from Red Hills to Kilpauk, herein described, to more than double the conduit capacity. The Rs 55 lakhs cost was borne by a Government loan and grant. Further improvements, planned, include a separate trunk-main for South Madras, laying of a duplicate 48-in. pumping main, betterments to the distribution system, and provision for rapid mechanical filters.

Until about a century ago Madras depended on wells for its water. In 1870 a supply system was built which tapped the Kortalayar River with a 6-ft. wier at Tamarapakkam, 25 miles to the Northwest. Water was taken by an Upper Supply Channel to Cholavaram Lake, thence via a Lower Channel to Red Hills Lake. For these many years water has been drawn directly from Red Hills Lake. Two arched masonry conduits 7½ miles long today convey water to the Kilpauk Water Works, where it is filtered through slow-sand filters, chlorinated and pumped into the city distribution system.

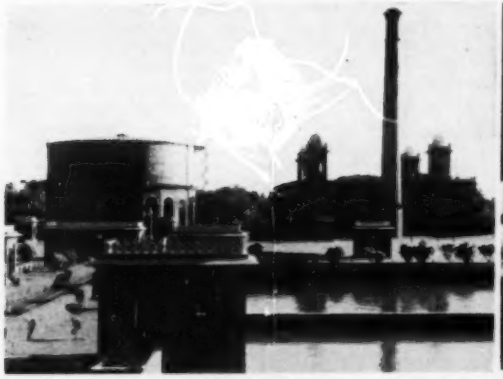
The two lakes, Cholavaram and Red Hills, normally supply irrigation water for 7500 acres of land and about 1400 million cubic feet per annum for the city supply. The lakes lose an estimated 1,100,000,000 gals. annually from evaporation.

The old wier at Tamarapakkam proved so inadequate that in 1940 construction was begun on a new reservoir at Poondi, 37 miles from Madras, since named "Satyamurthi Sagar." This reservoir, completed in 1944, is located 12 miles upstream from Tamarapakkam. It impounds 2,500 million cu. ft., a capacity nearly equal to that of the two lakes below. Water thus impounded passes down the river, into the old reservoir, and through the existing channels and lakes heretofore described. The new reservoir proved its worth during the successive failures in 1947 and 1948 of the Northeast Monsoon.

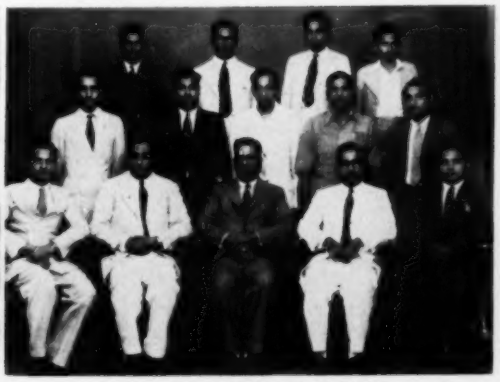
The first conduit built many years ago into the city from Red Hills Lake, with 23 m.g.d. capacity, consists of a masonry box 5' wide by 4' wall height, with inverted floor and arched roof giving 5'9" max. height. Gravitational flow is produced by an average gradient of 1 in 4470.

New Conduit Details

The Second Conduit, completed late in 1949, parallels the older conduit, and consists of a 6½'x4' masonry box with arched roof, designed with 1 in 5150 gradient for 32 m.g.d. capacity. Reinforced concrete pipe had been planned for this project, but war conditions made it difficult to obtain the necessary reinforcing steel. The total length of this line is 39,485 ft. Four different cross-sections were



Kilpauk Filtration Plant and Pumping Station of Madras
2M.G. Steel Balancing Tank With Ornamental Base on Left.

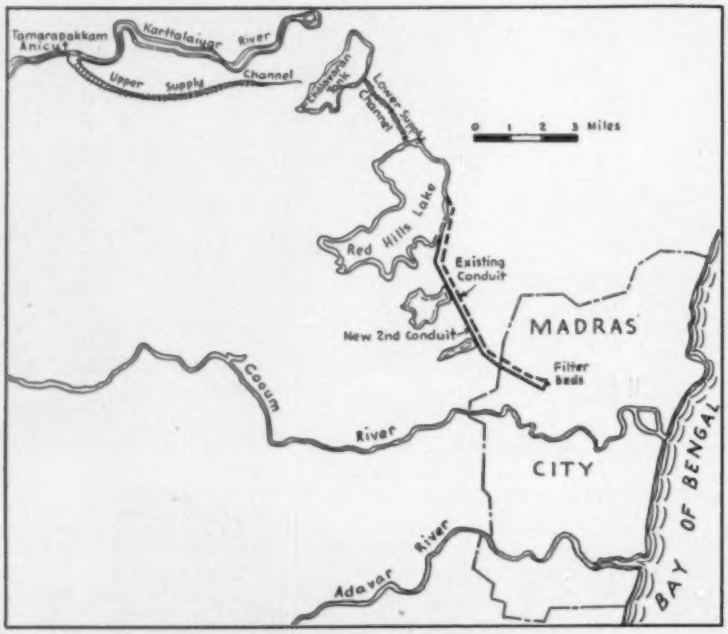


Technical Staff, Madras Water Works
Seated at Center: Chief Water Works Engineer, M. M. Achari. On his left: Executive Engineer, O. T. Raghavan.

The New Arched Roof Brick Aqueduct Under Construction
Note Thickness of Side Walls and Arch Through 24 ft. Cut.

Where Conduit Crossed Under Railway Line
The 20 ft. Girder Trestle Was Specially Constructed for the Purpose. Here the Conduit Was Founded on Well Foundations.

Close-up of Stock Brick Arch of Conduit
Wood Centering Helps in Execution of Design. The Lining is of 1:3 Cement Mortar ¾" Thick.



Map of the Sources of Madras Water Supply

Location of Old and New Conduits and Purification Plant Within the City.

adopted for the design, providing for varying thickness of stepped sidewalls and footing, and varying numbers of layers of arch brick in the top, according to the depth of backfill and the foundation conditions encountered.

All conduit cross-sections included the following: (a) footing slab consisting of 1-2-4 concrete made with cement mortar and ¾-in. stone jelly; (b) invert lining of 1-2-4 cement concrete 4½ in. thick; sidewalls keyed to the bottom slab and made with stock bricks in 1-3 cement mortar; arches of same construction as walls.

The conduit is below ground surface most of the distance, and 24-in. overflow outlet pipes with sluice valves have been provided, also affording entry to clean the conduit. Interconnections between the old and new parallel lines are built for use in case of emergency need to divert water from either line to the other. Manholes are spaced at 1,000 ft. intervals, each manhole having a 6-in. steel pipe ventilating column. At drainage crossings, siphons are provided which include suitable drops for non-silting velocity.

The 7½ miles of the Second Conduit was placed under contract in 1946, work progressing simultaneously on four sections. A shortage of steel sheet piling and sheeting timbers hampered the work in places, but the exceptional dryness due to partial failure of the Monsoon helped work progress. Work sections were dammed off to protect against untimely rains, and large pumping capacity was required to control the ground water. In Section I construction was carried to a depth of 15 to 24 ft. in the lake bed along the edge of Red Hills Lake, working in clay topped with gravel. In Section II excavation varied from 9 to 19 ft., consisting of gravel in the lower strata topped by shaley clay. Open slopes of ½ to 1 proved satisfactory. Where the conduit crossed a drainage channel the covering slab was carried down an additional 2½ ft. below the natural channel bed, and an apron of 12-in. thick concrete blocks provided against erosion.

Section III required timbering of sandy soil and heavy pumping to control ground water. The conduit was passed under a railway line, the railway being carried over it on a bridge.

The project required about 2,000 laborers for more than two years.

Present System Facilities

The present water works at Kilpauk includes 14 slow sand filters 200′ x 100′ and three at 200′ x 130′. The raw water is chlorinated before entering the filters. Average filtration is about 8 in. vertical per hour. The filtrate enters underground tanks of 6½ million gallons storage capacity. Four filtered water tanks are independent of each other, so that each can be isolated for cleaning. All filtered water is again chlorinated before entering the tanks with an average dose of one part per million. Water is sent into the distribution system via a 48-in. steel pumping main about one-half mile long. An elevated steel tank of 1½ million gallons capacity serves as a balance tank. Two electrical pumping units and three high-duty Worthington direct acting steam pumping units have a combined capacity of 32,000 gal. per min. against an 80-ft. head.

The city's distribution system presently comprises 29.5 miles of trunk mains and sub-mains from 48″ to 9″ diam., and about 365 miles of laterals and street mains. Electric boosters have been in use for some years to serve high-level and outlying areas, in conjunction with underground storage tanks to help equalize supply. The city has 54,000 private house connections. About 4000 connections, embracing all industrial and commercial connections, are metered.

There are 2,670 fire-hydrants, 3,595 public fountains, 182 bathing fountains and 64 cattle troughs in the city.

Current and Planned Improvements

Current improvements and extensions planned for the city include a duplicate 48-in. steel pumping main, a trunk main 42″ diam. for South Madras, laying of new street mains where none now exist, renewal of 4 in. mains, and replacement by larger sizes. Rapid mechanical filters to step up filter capacity, to accommodate the combined flow of the two conduits, is another much needed improvement contemplated. And, with an eye on future droughts and the expanding population needs of Madras, thought is being given to developing additional new water supply sources, including the Krishna-Pennar scheme.

Purification—Past, Present and Future

Before 1914 Madras did not have any system of filtration. Water used to be conveyed in an open channel from Red Hills to Kilpauk and then

let into the distribution pipes without receiving any sort of treatment. The open channel was subject to serious pollution by persons bathing in it or throwing things into it, and cattle finding their way into it.

It was only in 1914 when the first underground conduit and filtration plant were completed and the water works at Kilpauk began to function. The slow sand filters were found defective even from the very start. The effluent gave a bad smell and taste due to evolution of sulphuretted hydrogen in the underlayers of the filters and very poor, and unsteady analytical results, chemically as well as bacteriologically, were experienced. The question of improving the quality of the water so supplied to the City has been receiving the attention of both the Corporation of Madras and the Government since 1916. Experimental filters were constructed at Kilpauk in 1927, with a view to determine the best method consistent with economy for dealing with Red Hills water. After prolonged and varied experiments the Committee decided that the best method of filtering and purifying the Red Hills water would be by rapid mechanical filters. A plan has been prepared for adding rapid mechanical filters (40 m.g.d. cap.) and has been approved by the Government's Chief Engineer. The cost is estimated at Rs. 77.50 lakhs for the 40 m.g.d. installation, and this expenditure is now awaiting sanction of the Government, and it is hoped that the authorities will approve the loan and grant applied for—50% loan and 50% outright grant to the Corporation of Madras.

Sri. O. T. Raghavan, (B.A.,B.E., A.M.I.E.), Executive Engineer of Water Supply, is in direct charge of the design and execution of improvements under the control of Sri. M. Munisami Achari, (B.A.,B.E.), Chief Water Works Engineer.

P.C.A. DEDICATES NEW $3,000,000 RESEARCH & DEVELOPMENT LABORATORIES

On June 7th the Portland Cement Association dedicated its new $3,000,000 Research and Development Laboratories which are located about 16 miles northwest of Chicago. The P.C.A. is a non-profit organization supported by 67 member companies. The objective of the Association is to extend and improve the uses of portland cement and concrete. It was established in 1916 and has maintained its main office and research laboratories in Chicago since organization. Membership in P.C.A. is comprised of cement manufacturers representing 90% of the cement production in the U.S. and Canada.

The new laboratories are the largest and most completely equipped laboratories in the world devoted to research on cement and concrete. There are two architectural concrete buildings with a total floor space of 98,000 square feet.

There are more than 30 specialized laboratories, testing and curing rooms in the two buildings. In some of these spaces conditions of arctic cold, desert dryness and tropic heat are duplicated, with temperatures ranging from 20 degrees below zero, Fahrenheit, to 130 degrees Fahrenheit. Variations in relative humidity from 15 to 100 per cent are also possible. Equipment ranges from the very delicate and highly complex, to powerful testing machines, one of which is capable of exerting one-million pounds of pressure on concrete specimens up to 30 ft. long, 15 ft. high and 10 ft. wide. The new laboratories more than triple the former facilities in downtown Chicago.

The dedication, followed by inspection of the new laboratories and research facilities, was attended by several hundred of the nation's top-ranking scientists and engineers who heard principal speeches by C. F. McHering of General Motors; Frank T. Sheets, P.C.A. President; W. A. Ruesell, Chairman of P.C.A.'s Board and Dr. Allan Bates, P.C.A.'s Vice President in charge of Research and Development who reviewed the advances being made with pre-stressed concrete for girders and beams as well as concrete pipes for high pressure transmission mains.

SULFATE ION DETERMINATION WITH BENZIDINE DIHYDROCHLORIDE

by

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Engineering Experiment Station
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IN the analysis of water, the concentration of the sulfate ion is frequently determined by precipitation as benzidine sulfate, after which the precipitate is filtered, transferred to a beaker, suspended in water, and finally titrated with sodium hydroxide to a phenolphthalein end point. This procedure, as outlined in *Standard Methods for the Examination of Water and Sewage*[1], has 2 serious limitations. First, it may be applied only over a range of 120 to 500 p.p.m., and second, it requires a blank and is accurate only to one part in twenty.

METHOD

This paper presents a modification of the Standard Methods[1] technique which is applicable over a wider and more useful range, 2.0 to 400 ppm., and accurate to within 1.5 per cent from 20 to 200 ppm. without using a blank titration.

Reagents

Phenolphthalein indicator solution, 0.5 per cent.

Sodium hydroxide solution, 0.02 N.

Benzidine dihydrochloride reagent: Dissolve 9.0 gm. benzidine dihydrochloride in 150 ml. of 0.1 N hydrochloric acid and dilute to 500 ml. with distilled water.

Procedure

Adjust the pH of a 100-ml. sample to a phenolphthalein end point with either sodium hydroxide or hydrochloric acid, heat rapidly to the boiling point, and remove the flame quickly. Slowly add 10 ml. benzidine dihydrochloride reagent. Stir continually and gently (100 to 150 rpm.) until the mixture reaches room temperature, then chill in a refrigerator. Filter through 2 discs of filter paper (Whatman 542, 2.1 cm. diameter) contained in a Gooch crucible, using light suction. Transfer the remaining precipitate from the beaker to the crucible, using 3 small portions (10 ml.) of the filtrate. Wash the precipitate with five 1-ml. portions of iced distilled water. Place the crucible in a clean beaker and cover with approximately 100 ml. of distilled water, the pH of which has been previously adjusted to a phenolphthalein end point. Heat to boiling and titrate with 0.02 N sodium hydroxide.

Calculation

Calculate the concentration of the sulfate ion as follows:

$$\frac{\text{ml. NaOH} \times 0.02 \times 48 \times 1000}{\text{ml. sample}} = \text{ppm. } SO_4$$

Results

A number of sodium sulfate solutions containing known concentrations of the sulfate ion which varied from 10 to 400 ppm. were analyzed. Within the range 20 to 400 ppm., an average error of —1.5 per cent was obtained. At concentrations less than 20 ppm., the average error increased in magnitude as the sulfate ion content of the sample decreased; however, reasonable accuracy was obtained with solutions containing as low as 10 ppm., a deviation of 0.5 ppm. being noted at this concentration.

This procedure was then applied to the analysis of several natural waters; the results of these analyses are shown in Table I. As a check upon the accuracy of the determinations, each sample was divided into 2 portions; the sulfate ion concentration was determined directly in the first portion, while a known quantity of sulfate was added to the second portion prior to the determination of the sulfate ion. As may be seen from a study of the data in Table I, excellent correlation of results was obtained, even in samples containing as low as 3 to 4 ppm.

Table I

RESULTS OF THE ANALYSIS OF SEVERAL NATURAL WATERS

Sample No.	Sulfate Ion Concentration* By Direct Analysis ppm.	By Increment: Amount Added ppm.	By Increment: Total Recovered ppm.	By Increment: Increment ppm.	Deviation ppm.	Concentration of Other Ions: Ca^{++} ppm.	Mg^{++} ppm.	Cl^- ppm.	$PO_4^{=}$ ppm.	NO_3—N ppm.
1	60.5	43.5	104.0	60.5	0.0	49	5	13	0.30	24
2	40.1	43.5	82.8	39.3	—0.8	59	15	93	0.04	11
3	34.7	43.5	80.3	36.8	+2.1	33	----	----	----	----
4	3.2	94.7	97.0	2.3	—0.9	12	1	1	-----	0
5	3.2	94.7	98.0	3.3	+0.1	9	2	4	-----	5
6	1.3	94.9	93.0	—1.9	—3.2	3	1	0	-----	0

*All values are the average of at least duplicate determinations.

DISCUSSION

The following are possible sources of error in the determination of the sulfate ion by this method, listed in their probable order of occurrence:

(1) Incomplete precipitation of benzidine sulfate.
(2) Solubility of benzidine sulfate in wash water.
(3) Variation of crystal size of benzidine sulfate.
(4) Absorption of benzidine dihydrochloride on filter paper.
(5) Vague end point.
(6) Small volume of sodium hydroxide required.
(7) Effect of dilution water intitration with sodium hydroxide.

In developing this procedure, the above listed sources of error were studied in an effort to minimize their effects with, in general, only one factor being investigated at any one time.

Phosphates have not been discussed here as a possible source of error, but they must be absent if the benzidine technique is to be used.

Incomplete Precipitation

There are several possible reasons for incomplete precipitation of the sulfate ion when using benzidine hydrochloride. Because of the limited solubility of benzidine hydrochloride at the low hydrochloric acid concentration used, the sulfate ion concentration may not exceed 500 ppm. in 100 ml or there will be an excess of sulfate ions. As one approaches this concentration it is recommended that a smaller aliquot be taken and diluted to 100 ml. with distilled water.

The solubility of the benzidine sulfate is much greater at higher temperatures than at lower temperatures; therefore, it is recommended that the sample be chilled before the precipitate is removed by filtration. Elimination of the chilling will tend to give

lower recovery of the sulfate ion; at times, no precipitate forms until the sample has been chilled.

The solubility of both benzidine hydrochloride and sulfate are dependent upon the pH of the solution. From the results shown in Table II, it appears that the benzidine sulfate is not completely precipitated at the concentration of 25 ppm. sulfate and pH 1.5. It would appear that some benzidine hydrochloride is coprecipitated with the benzidine sulfate at pH 3.4. For low sulfate ion determinations it is recommended that pH 2.3 to 2.7 be used. In this range excellent recovery may be obtained at low concentrations of sulfate ions, and good results may be obtained over a wide range of sulfate ion concentrations (sufficient excess benzidine hydrochloride can be held in solution).

It was thought that the problem of differentiating between excess reagent or minimum solubility of the benzidine sulfate might be clarified by weighing instead of titrating the precipitate. The results in the last line of Table II only raised more questions.

The amount of acid added to the reagent should be such that the sample plus the reagent will yield a pH within the range 2.3 to 2.7. A number of authors have suggested the use of buffers to obtain the correct pH, but the use of buffers involves the problem of washing the precipitate and filter paper free of excess buffer without losing the precipitate.

Table II

EFFECT OF pH OF SOLUTION AT THE TIME OF BENZIDINE SULFATE FORMATION UPON RECOVERY OF THE SULFATE

Methods of Analysis for Benzidine Sulfate	Theoretical	Sulfate Ion Concentration, ppm. with probable error			
		pH 1.5	pH 1.9	pH 2.7	pH 3.4
Titration	25.0	19.5±.4*	24.8±.1	25.4±.1	31.5±.4**
Titration	50.0	44.8±.6*	50.6±1.2	49.4±.2	50.4±.2
Titration	100.0	99.0±.4	100.3±.2	101.2±.2	101.2±.1
Gravimetric	100.0	106.5	91.9±1.3***	92.0±1.2	102.6±.2

*The precipitate is very slow in forming.
**These results indicate that there is probably some double salt formation in the crystals of benzidine sulfate.
***Apparently, excess reagent is present.

Solubility of Benzidine Sulfate

The washing of the precipitate is one of the most delicate operations in the entire procedure, as the excess benzidine dihydrochloride reagent present must be removed without dissolving an appreciable amount of benzidine sulfate. A number of washing media have been recommended in the literature, including distilled water[3], acetone[3], a saturated solution of benzidine sulfate[1,2], and the filtrate itself for transferring the precipitate, followed by distilled water[6]. Several of these were tried in the laboratory with the following results: Acetone, 2.5 per cent low; saturated benzidine sulfate solution, 2.5 per cent or more high; and filtrate followed by distilled water, 1.5 per cent low. The investigators of the latter method, Friedheim and Nydegger[6], recommended that 10 ml. of distilled water be utilized as the final wash; however, slightly better results were obtained by successively washing the precipitate with only five 1-ml. portions of iced distilled water, possibly because of the very small amount of the filter paper used. The use of the filtrate for transferring the precipitate to the funnel would seem to be identical to the use of a saturated solution of benzidine sulfate reagent[1,2]. However, the filtrate has excess benzidine reagent in equilibrium with the precipitate and its use yields lower sulfate ion concentrations than those from saturated benzidine sulfate solutions. This difference in sulfate ion concentration is evident from the cloudiness which develops in the filtrate when a saturated benzidine sulfate solution is used to wash the precipitate.

Variation of the Crystal Size

The attainment of optimum crystal size is of considerable importance, since very fine crystals are difficult to retain on filter paper, particularly with vacuum filtrations while large, irregular ones tend to cake, thus prolonging the subsequent titration. It was found that the most easily handled crystals were those which had a regular shape and were of a medium size. The best method of obtaining such crystals is the procedure which has been described previously, in which precipitation is carried out in a hot solution, stirring continually and gently while the solution is being cooled to room temperature and chilling in a refrigerator prior to filtration. It was also found that a mechanical stirrer rotating at 100 to 150 rpm. gives the best results; very rapid stirring results in the formation of very fine crystals, while no stirring or very slow stirring gives large, nonuniform particles. The importance of carefully adjusting the conditions under which the precipitate is formed may be illustrated by comparing the results of two determinations. In one instance, the sample was neither heated nor stirred, yielding results which were 6 per cent low, while in the other the sample was treated in accordance with the standardized procedure, with results which were only 1.5 per cent low.

Vague End Point

The choice of the proper filtering medium was of considerable assistance in minimizing this source of error. Two different media were tried, namely, filter paper pulp, which is recommended in the "Standard Methods" procedure, and filter paper discs. The discs proved to be more satisfactory than the pulp; when analyzing a sample containing 48 ppm. sulfate ion, results which were 2.5 per cent low were obtained with the latter material, while an error of only —1.5 per cent resulted from using the discs. This difference may be attributed to the reduced amount of washing necessary and to the fact that the relatively small discs did not interfere with the determination of the end point. It was also found that the use of a larger volume of dilution water than was recommended in "Standard Methods" yielded sharper end points. The larger volume can be used by titrating the dilution water to a phenolphthalien end point before diluting the precipitate. In adidtion, it was determined that the sharpness of the end point could be increased by titrating in a hot solution, an observation which is amply substantiated by the literature. The use of a hot solution was also advantageous in that it lessened the chances for carbon dioxide to be absorbed and increased the dissociation rate of the benzidine sulfate, which, of course, reduced the time required to perform the titration.

Small Volume of NaOH

The procedure outlined in "Standard Methods" recommends that 0.1 N sodium hydroxide be employed in titrating the benzidine sulfate suspension. However, because of the small volumes of alkali required, it was found that more accurate results could be obtained with a solution having a normality of 0.02.

Adsorption of Benzidine Dihydrochloride

This difficulty was eliminated by the use of the small discs of filter paper instead of the filter paper pulp recommended in "Standard Methods."

It should be noted that the above

described technique also differs from the "Standard Methods" procedure in that no provision is made for running a blank determination. The primary purpose for the inclusion of the blank determination in the "Standard Methods" procedure was to allow for the correction of errors caused by the adsorption of benzidine hydrochloride reagent on the filter medium and by the use of unadjusted dilution water. As indicated above, these sources of error have been eliminated by the use of filter paper discs and by adjusting the pH of the dilution water; therefore, no necessity exists for the inclusion of a blank determination in this procedure. The accuracy of the data obtained in analyzing samples containing concentrations of 3 to 4 ppm. sulfate ion (Table I) is considered to be further confirmation that a blank determination may be safely eliminated from this procedure.

Acknowledgement

The work described in this paper is a part of a project supported by a grant-in-aid from the National Institutes of Health of the United States Public Health Service for research on rapid analytical procedures for water and sewage.

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Lloyd Huffman Heads Dayton Water & Sewage Works

W. W. Morehouse Retires

Lloyd Huffman, Supt. of Sewage, Dayton, Ohio, has been promoted to

L. Huffman

W. W. Morehouse

the position of Director of Engineering of the Division of Water and Sewage for the City of Dayton. In his new capacity, he will replace W. W. Morehouse who retired from the position to become Consultant to the City of Dayton on the Construction of a new water works. Mr. Morehouse is a past director of the AWWA from the Ohio Section and has been active in Ohio Section affairs for many years. Mr. Huffman has been active in the Ohio Sewage and Industrial Waste Treatment Conference.

New England Industrial Wastes Conference

The Massachusetts Institute of Technology, Cambridge, Mass., held a three-day "New England Industrial Waste Conference" on June 26-28. The conference was held in cooperation with the New England Council and the New England Sewage Works Assn. It was under the auspices and direction of the Department of Civil and Sanitary Engineering with Dr. Rolf Eliassen, Prof. of San. Engr. and Dr. Clair N. Sawyer, Prof. of San. Chem. in charge of arrangements.

This new conference was designed to consider the increasingly acute problem of stream pollution by industrial wastes. Three groups of interested parties were brought together for the discussion of control problems and processes for treating industrial wastes. These groups were industrialists, representing management, chemical engineers and sanitary engineers; representatives of stream pollution control agencies, on federal, regional and state levels; and research workers and consulting engineers concerned with the processing of industrial wastes and water supply problems.

In addition to general discussions of pollution abatement from the viewpoints of industries, control agencies, and municipalities, there were symposia on the water and waste problems of specific New England industries. There were 25 formal paper presentations and the meeting concluded with a special discussion of future needs and developments. Inspection trips were made to three industrial waste treatment plants.

Poughkeepsie's Cole Retires

Thos. A. Cole, Supt., Water Dept., Poughkeepsie, N.Y. retired at the end of May after 44 years of service in the water works field. More than thirty-five years had been spent at Poughkeepsie, with the early eight years and seven months spent at Auburn.

Mr. Cole began work at Poughkeepsie under the late William T. Carpenter, Chemist. Other pioneers who aided him were Allen Hazen, George C. Whipple, Francis Longley, and Malcolm Pirnie who still is consultant to the city. Mr. Cole served two years (1939-40) on the AWWA Committee on methods of standard practice. He has been active in the New York Section of AWWA.

Upon his retirement, Mr. Cole boasted a record of 41 years and 4 months of water chlorination experience. If any one has a longer record, Mr. Cole and the editors of this magazine would like to hear about it. Mr. Cole's experience with water chlorination began on Feb. 1, 1909.

Lesson in Economics

The following material is reprinted directly from *Water Lines*, the house organ of the Indianapolis Water Co. *Water Lines* is edited by John Kleinhenz, Director of Publicity for the company. The item below needs no further comment. It is truly a lesson in economics.

TED $ VS BABE $

"Williams Signs With Red Sox for Record Baseball Pay of $125,000"

That was the headline you read last February when Ted Williams, the Red Sox slugger, signed the highest salaried contract in baseball history— for an estimated $125,000.

Babe Ruth's $80,000 salary in 1930 and '31 was tops in the old days.

But did Ted get that much more? The Foundation for Economic Education, Inc., illustrates the question this way:

DOLLAR SALARIES
This is a comparison of Ruth's and Williams' dollar salaries.
$80,000
$125,000
RUTH 1931
WILLIAMS 1950
TAKE-HOME PAY
But after federal income taxes, this is a comparison of their take-home pay.
$66,535
$62,028
RUTH 1931
WILLIAMS 1950
WHAT THE TAKE-HOME WILL BUY
Inflation has shrunk the buying power of the dollar since 1931, so Williams' real take-home pay is only a little over half of Ruth's—57%.
RUTH 1931
WILLIAMS 1950

If Ted Williams were to have as much buying power in 1950 as Babe Ruth had in 1931, he would have to be paid $327,451!

OPERATION OF SMALL WATER PLANTS

Organization and Service

by

A. E. CLARK
Manager
Nashville Suburban Utility District
NASHVILLE, TENN.

THE operation of any utility, like any business or manufacturing enterprise, depends upon the organization. Without proper organization very few private businesses could operate or compete in our present, complicated economic system. A private utility while it does not usually compete with another system serving the same area, must have a business set up so that not only all operating and maintenance expenses can be met, but is in a position to expand as required to provide services in newly developed areas, etc. When money is borrowed for extensions and expansion there must be a return on the investment sufficient to take care of all costs. A municipal utility should operate in the same way, because if the return from water sales for instance, is not sufficient to meet the costs, then it is necessary to obtain the additional funds from taxation. Too many times, particularly in the small systems, little thought is given to organization. However, it is just as necessary in the small as in the large plant; the only difference being in size. The small plant has practically all the problems of the large plant except on a smaller scale. Therefor, why not profit from the experience of the large plant. Text books as well as the material contained in the various journals and information sent out by the various manufacturing concerns contain a great deal of material that can be used profitably by the superintendent of the small water plants. Attendance at the A.W.W.A. conventions each year and the state section meetings provide an abundance of information for the asking. Many problems are thrashed out at the various meetings, not only on the convention floor but in the hotel lobby. Contact with other people doing the same type of work and having somewhat similar troubles helps toward getting the situation cleared up.

The Meaning of Sound Policy

One of the most important parts of the organization is the policy adopted for its control. Aside from this there are certain rules and regulations applying to the actual operation of the utility. Policies as well as rules and

The Author

regulations must be reasonable and workable. Too often a policy is adopted without studying all the angles, then the first time it is applied an "exception" crop up. Policies should be general enough to apply to all cases, because as soon as the exception is made there is the possibility of setting a troublesome precedent. As few policies and rules and regulations as possible should be adopted consistent with good management and operation. The personnel must be familiar with all policies and rules and regulations with no authority to deviate from them. If a question arises regarding any of the policies or rules and regulations such a question should be settled by the person or persons responsible for them. If and when changes are made everyone should be familiar with the changes. Dealing with the general public is a job in itself. Personnel having contact with the consumers should be selected with a great deal of care. Their judgement of the utility is based to considerable extent on contacts with the employees.

The organization of the office should be such that routine operations flow smoothly. A sufficient number of checks should be set up so that in the event of an error it will usually be detected before any operation is complete and correction can be made. When a consumer comes to the office his wants should be satisfied as expeditiously as possible. The arrangement of records, etc., should be such that confusion will be avoided.

The field organization requires just as much care in the selection of the employees as the office. This is the service part of the utility and these are the employees whose duty it is to see that the consumers have the service for which they are paying. The men for the various duties must be selected for their particular aptitude in the type of work to which they will be assigned. In the small water works the permanent crew is usually small and there is an interchange of duties. Here the set up differs radically from the large systems which have and require sufficient personnel for the different types of work.

Utility is Primarily a Service Organization

The utility is primarily a service organization and it is set up for that purpose. The only question is—What type, and how much service, is the water department prepared to render? In the matter of complaints regarding high water bills. Is the consumer made to feel that everything will be done to determine the cause, such as re-reading the meter or testing it, if need be. If the reading is correct and the meter registers correctly is anything further done such as checking the premises for leaks. Many times excess use of water can be determined by talking with the housewife or maid. Good relations are maintained by giving the consumer all help possible within reason. When a consumers bill doubles in a quarter, or month, he wants to know the reason and assumes of course that the water department is wrong. He assumes that the meter-reader misread the meter, or didn't read it at all; meter is not registering correctly; rates have been increased, and any other number of reasons A complaint which is heard frequently is that the meter was not read. This complaint can be handled by having the meter re-read and giving the consumer his previous and last readings to show that the meter was actually read. And, he can also be advised regarding his next bill, based on the quantity used when the meter was re-read. Of course, this estimate on his use of water for the remainder of the period is based on use between the regular reading and the re-read.

Adjusting Excessive Bills

Leakage on the premises of a consumer causes a higher bill than average, many double and triple, depend-

ing on the size of the leak. Regardless of the type of leak, visible or hidden, the consumer usually assumes that he is entitled to an adjustment. This practice can become very troublesome and expensive. The water department is interested in every consumer paying for the water consumed, but at the same time, it would prefer that all leaks be stopped and the consumer pay an average bill covering his particular use of the water without excessive waste or leakage. Many water departments make adjustments for hidden leakage, based on a statement by a plumber or some other individual that the leak had been repaired. The amount of the adjustment varies but some policy can be adopted which will allow adjustments for certain types of leaks, such as hidden leaks which ordinarily would not be detected by the consumer. Those which are detectable, such as leaking toilets or faucets, should be held to represent neglect on the part of the customer, and not subject to adjustment.

The consumers themselves can be of considerable help and render a very important service to any water department. A consumer living in a certain locality over a period of time usually notices the drainage, etc. Say, during a dry spell an unusual amount of water is noticed by a consumer in front of his residence. Many times he will call the water department and report it. If a leak is found, the consumer reporting it should be thanked in such a way that he will feel he has rendered an important service to the department and even though the drainage is from another source he is entitled to be thanked for his interest in reporting the condition, because some time in the future he might advise of something really important. Many times a meter coupling will leak. On inside settings the consumer will notice it immediately, but on outside settings this may not be true and a report by a consumer that water is coming out of the meter box is very helpful in getting the leak stopped much sooner than might be the case if it was not reported. The report is made frequently because he thinks the leak is registering on his meter. After a leak of this character is repaired he can be notified that the leak was or was not registering on his meter. It is felt that if the leak *was* registering on his meter he is due an adjustment.

Make it Easy for the Consumer To Report Emergencies

A water department operates 24 hours a day seven days a week. Many breaks, leaking joints, etc., do not always occur during the daily working hours and since there is usually no one on duty at the office of the water department every consumer should know who to call in case of an emergency during the hours the office and/or shop is closed. This can be done by an extra listing in the telephone directory showing the number or numbers which can be called, nights, Sundays and holidays. Another method of bringing it to the attention of the consumers is to print the same information on the water bills. This serves as another service to the consumer, because he then feels free to call the department in case of trouble. The consumer has every right to expect service at any time providing it comes within the duties of the water department. This does not hold strictly in every case since there are many things which can happen in the modern home and so many times the consumer is totally ignorant of the operations. He might call to say that hot water is coming out of his cold water faucet and he does not know what to do. Obviously something has gone wrong with his water heater, particularly if heated by other than the furnace. He can be told what he can do and then advised to contact his service man for that equipment. While it may be annoying to receive telephone calls at home for such things, it does pay off in better public relations.

A water utility being primarily a service organization every means should be used to apprise the consumers of this fact. The American Water Works Association has sent to its members considerable material useful in developing better "Public Relations." The small water works superintendent may believe that this material is only applicable to the larger utilities, but this is not the case. There are numerous ways in which advantage can be taken of this information, particularly by featuring "Willing Water" as symbolic of water service. In the small water works this material can be used very effectively on the water bills. Everyone looks at the bill and although the use of material stressing the service given by the water works does not lessen the amount of the bill, it does give the consumer something to think about in the matter of the service he is getting for a modest expenditure.

Wirts Again Heads Cleveland Easterly Plant

J. J. (Jack) Wirts has again become full time Supt. in charge of the Cleveland Easterly Sewage Treat-

ment Works, after several months of dividing his time between that post and the engineering department of the city.

This is the same position Mr. Wirts left in 1946 to enter private business, and it is a credit to the City of Cleveland that one of the able young men of the sanitary engineering field has returned to the fold, so to speak. Prior to last February when "Jack" began to shuttle from the engineering department of the city to the Easterly plant, he had been working full time as an engineer in the city department, after leaving private employment about a year and a half ago.

New Kent's Handbook Available

Kent's "MECHANICAL ENGINEER'S HANDBOOK" for more than 50 years, the classic in its field has just been issued in a new 12th edition by John Wiley and Sons, New York City.

The new edition consists of two volumes written by a large staff of experts, and reflecting the developments in mechanical engineering since the 11th edition in 1936. Vol. I on "Design and Production" was edited by Colin Carmichael, Editor of Machine Design; Vol. II on "Power" was edited by J. K. Salisbury of the General Electric Co.

The 12th edition retains the handy size and flexible covering of the previous edition and while the material is condensed, the volumes are larger than in the 11th edition. Practice, rather than theory, is stressed in the new "Kent" and a new highly usable index has been included. One hundred sixty-eight specialists contributed to the new edition as compared with seventy-five for the outgoing edition.

The new two volume "Kent's Handbook" is approximately 8000 pages in length and may be purchased from John Wiley & Sons, Inc., 440 Fourth Ave., New York City 16, N.Y. The price is $8.50 per copy.

FLUORIDES IN AIR OF WATER PLANT FEEDING SODIUM FLUORIDE*

by
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Superintendent
BD. OF WATER COMMISSIONERS
SHEBOYGAN, WIS.

THE City of Sheboygan, Wis., inaugurated its fluoride water treatment program in February of 1946. At the time, it was thought advisable to provide the charging hopper in the chemical storage room, above the feeding machine, with a suction fan and dust filter to prevent contamination of the air in the chemical store room with fluoride dust. The feed machine itself had been rendered as dust tight as possible in its construction and installation.

It was further considered advisable to provide each operator with his own dust mask of a type approved for protection against toxic dusts to be used when filling the feed machine. This equipment was on hand and in use on the first day of fluoride feeding and continuously since. In addition to these precautions against inhaling fluoride dust during the hopper filling operation, the operators are required to wear rubber gloves which have a gauntlet cuff, to wash the gloves under running water before removing them, and to thoroughly wash the hands after removing the gloves.

While there was no apparent reason to doubt the effectiveness of the precautions which were in force, it could not be known positively that they were effective without tests, so arrangements were made with the Wisconsin State Board of Health Division of Industrial Hygiene to test the air in the vicinity of the feeder on the main operating floor of the plant and at the charging hopper in the chemical storage room before, during, and after a filling of the hopper.

Experimental Observations

On Aug. 22, 1949, E. J. Otterson and W. H. Poppe, Jr., engineers of the Industrial Hygiene Division, with the co-operation of J. A. Rutkauskas, Superintendent-Chemist of the water plant, took air samples in the plant and on Sept. 1 submitted their report. The samples were collected at a rate of 1 cu. ft. per min.

*In the June issue, Mr. Zufelt reported on the use of sodium silico-fluoride for the fluoridation of water.

The Author

in a large impinger containing distilled water, and each sample was of ten minutes duration or 10 cu. ft. in quantity, except No. 3 which was five minutes and 5 cu. ft. The fluorides were determined colorimetrically using the zirconium alizarin method.

The results of the tests were as follows:

ATMOSPHERIC FLUORIDES—MILLIGRAMS PER CUBIC METER

Sample No.	Time	Location	Fluorides as HF. mg/M
1	10:23-10:33 a.m.	General atmosphere at operator's desk near Omega feeder. Prior to filling hopper.	.04
2	10:35-10:45 a.m.	General atmosphere of chemical storeage room. Next to hopper. Prior to filling.	.025
3	10:55-11:00 a.m.	Chemical storeroom. Breathing zone of operator emptying NaF barrel into hopper.	8.89
4	11:03-11:13 a.m.	General atmosphere on top of Omega feeder near flexible sleeve in chute immediately after hopper filling.	.134
5	11:15-11:25 a.m.	General atmosphere at operator's desk near Omega feeder. 15 minutes after hopper filling.	.050
6	11:29-11:39 a.m.	General atmosphere of chemical storeroom. Next to hopper. One-half hour after filling.	.119

The following note was appended to the test results: "The maximum allowable concentration for fluoride dust in an eight hour day, five days per week exposure is 2.5 milligrams per cubic meter. This figure is based on HF which has a maximum allowable concentration of 3 ppm." This was also the maximum allowable concentration as given to us in correspondence with the U. S. Bureau of Mines.

Comments on Data

The "Summary and Conclusions" of the report by Messrs. Poppe and Otterson were as follows:

"The only condition found in which the maximum allowable concentration was exceeded was in the actual filling of the hopper. It should, however, be borne in mind that maximum allowable concentrations are based on continuous 8 hour per day exposure, whereas the operation tested is one that is completed in five minutes, and never more than once a day.

"All other atmospheric tests were far below the maximum allowable concentration, showing only minute traces of fluorides in the air and indicating the high degree of efficiency resulting with the existing precautionary methods.

"It is recommended that the practice of wearing a respirator be continued during the time of hopper filling even though the buildup and presence of fluorides in the air is only of a transient nature."

Since the tests and reports were made a shipment of sodium fluoride has been received packed in 100 lb. paper bags instead of 375 lb. barrels. The open end of the bag is inserted down into the opening of the hopper when filling it, so that there is considerably less opportunity for dust to escape the suction of the dust filter equipment than when pouring from a barrel with the edge of the open end resting on the rim of the hopper.

Two or three fillings of the hopper are the maximum per week, and with four operators fulfilling the three eight hour shifts the average number of fillings per operator would be one in nine or ten days. Even if an operator filled the hopper every day and took 15 minutes to do it he would be exposed to fluoride equivalent to an 8 hour day exposure of only 1/32 of the 8.89 mg. per cu. meter determined for sample No. 3, or .28 mg. per cu. meter on the 8 hour basis, and of course he is protected with his toxic dust respirator while the sampling device was not.

Urine Studies

It was suggested by the Industrial Hygiene Division's engineers that as a further check to complete the study we should submit urine samples of the operators and compare the fluoride content with that of individuals using fluoride treated water but not working in the atmosphere of the plant. The fluoride concentration in urine is closely related to fluoride intake into the body, as described in a paper by F. J. McClure, Senior Biochemist, and C. A. Kinser, Associate Chemist, of the United States Public Health Service, entitled, "Fluorine Content of Urine in Relation to Fluorine in Drinking Water" in PUBLIC HEALTH REPORTS, December 8, 1944, Vol. 59, No. 49.

Samples were taken and submitted on Sept. 19 for analysis. The report received from Otterson and Poppe follows:

"This is a supplementary report to the Atmospheric Fluoride Study of Aug. 22, 1949. At the time of the previous study, it was suggested that urine samples be collected from the water plant employees and the results of these samples used in conjunction with the atmospheric samples for the health evaluation from fluoride exposure as the result of adding sodium fluoride powder to the municipal water supply.

"On September 19, 1949, six samplaes were obtained from water plant employees and three other samples were collected from water department employees working in the downtown office. These latter samples were used to determine a control level for people that drank Sheboygan Water but were not exposed to atmospheric fluorides. The results of the nine samples are given in Table I.

Table I

URINARY FLUORIDE SAMPLES

Sample Number	Job Description	Fluoride Content as mg. HF/L of Urine
	A. Control Samples	
1.	Dept. Superintendent	0.44
2.	Office Manager	0.10
3.	Office Clerk	0.40
	Average	0.31
	B. Plant Samples	
4.	Plant Superintendent—Chemist	0.88
5.	Filter Plant Operator	1.04
6.	" " "	1.58
7.	" " "	0.52
8.	" " "	0.20
9.	Relief Filter Plant Operator	0.10
	Average	0.72

"Fluoride concentrations in urine above 2.0 milligrams per liter indicate that excessive amounts of this element are being accumulated in the body."

The "Summary and Recommendations" of this report by Messrs. Otterson and Poppe were as follows.

"(1) All urine samples from employees of the water plant were below the safe level.

"(2) The average concentration of the plant employees was 0.41 milligrams per liter higher than the office employees. In view of the findings of the August 22nd study and with the limited number of samples taken for this study, it is not believed that any significance should be attached to this difference in concentration.

"(3) It is recommended that similar sets of urine samples be collected approximately every six months."

This report of Sheboygan's investigation of atmospheric conditions in the water plant as a result of fluoride feeding is not offered as an exhaustive nor authoritative study of the subject, but as a factual report of conditions in the Sheboygan plant. It appears to us that the precautions taken have been adequate and that no fear of fluoride poisoning of those handling the material is justified if precautions such as we are using are conscientiously followed.

A. D. Caster Now at Cincinnati

A. D. Caster, who has been Sanitary Engineer in the Utilities Division of the 2nd Army Corps, Ft. Mead, Md., for a number of years has resigned that position to become Senior Sanitary Engineer of Sewage Disposal for the City of Cincinnati, Ohio. Mr. Caster's former duties took him all around the 2nd Corp Area. In his new duties he will be concerned with the sewage disposal program of Cincinnati in its efforts to abate pollution of the Ohio River as a part of the general cleanup of that stream under the guidance of the Ohio River Compact Commission.

Polluted Charles River Gets a "Drink" of $10./MG Water

Millions of gallons of pure sparkling drinking water from the Boston Metropolitan District Commission Water Supply System will be poured into the Charles River to alleviate pollution during dry periods. The Massachusetts' State Senate passed a special bill on June 26th permitting such use of the M.D.C. water.

The bill authorizes release of as much as 15,000,000 gals. per day into the polluted Charles to maintain a minimum flow. As much as 500,000,000 gals. may be used for such dilution during the dry season.

The M.D.C. is to be paid for the dilution water at the rate of $10.00 per million gallons. The bill will be paid by assessment against seven communities benefitting from the freshening of the Charles River. The communities and the percent of total cost to be assessed against each are as follows—Wellesley 8%; Weston 7%; Newton 22%; Waltham 15%; Watertown 13%.

While it may sound like stark heresy to spend good drinking for freshening up a polluted stream, as a matter of fact the expense to those benefitted, amounting to $150 per day, is a reasonable cost considering the benefits. Those of us in New York City, however, shudder to think of spilling 500,000,000 gallons of drinking water into any stream.

Yes, "Sonny," this is what is known as a sprinkling hose for the lawn and kiddies too on hot days. Some day when our City Fathers see that we have enough water again I'll show you how it works.

Water Conferences Held

Water Resources Policy Commission Sponsor

Conferences in several key cities were held during June and July under the auspices of President Truman's Water Resources Policy Commission. These meetings were held to obtain the views and opinions of various citizen's groups on the conservation and use of water. Meetings were held in Sioux City, Iowa, Spokane Wash., San Francisco, Calif., Denver, Colo., Fayetteville, Ark., Springfield, Mass., and Atlanta, Ga., and Phoenix, Ariz.

Among the questions dealt with were: extent of government participation in water resources programs, industry's concern about adequate water supplies, reduction of erosion, stream pollution, municipal water supplies, and civil defense.

SEWAGE WORKS DESIGN REQUIREMENTS

Collection Systems and Pumping Stations

The First of a Series of Articles Based upon the Current Official Regulations or Recommendations of the Health Departments of Various States.

by

LAWRENCE G. RICE

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CAMP HILL, PA.

WHEN issuing official regulations and recommendations governing the design of sewage works, a State Department of Health has in mind the correction of various faults in design, that have occurred in the past in their various works, and endeavors to improve them. Each state inspects all its treatment plants periodically, discusses operation difficulties with the operator, studies the monthly reports, and give advice to obtain better operation.

As a result each State has first hand detailed information of hundreds of plants. Combining many states, thousands of works are covered, and this represents the best, most accurate and up-to-date information. A composite interpretation of the most recently issued regulations by various states will, therefore, represent the most up-to-date design standards, in lieu of the fact that there are no universal general standards.

Exactly one half of the states have issued official standards and recommendations to cover design of works within their own jurisdiction. Of these, eight have been issued within the past three years, and ten in the previous five years.

Representatives from ten states comprising the Upper Mississippi River and Great Lakes Regions, have been for some time preparing design standards for sewage works which would be acceptable to all ten states, and it is expected will be adopted by them in the near future. This represents what is believed to be the first definite action toward universal standards for a common interest, and what is more significant, five of the states have not previously issued standards.

GENERAL SEWER REGULATIONS

The older existing sewer systems, especially in the larger municipalities, were built on the combined system to carry both sanitary and storm flows. Sewage treatment was not generally considered, and the combined system was most economical. Newer existing systems, having in mind treatment at some future date, were built on the separate system, one system carrying only sanitary flows, and the other the remaining storm and drainage waters, including unpolluted industrial wastes. Storm sewers are not included in the regulations for disposal of sanitary sewage.

All entirely new sewage collection systems should be installed on the separate plan, and all storm flows excluded from the sanitary sewers and also excluded from new extensions to existing sanitary sewers. Extensions to existing combined systems should carry only sanitary sewage, except in certain cases where the new drainage area is small and the stream receiving the outfall large, or for special economic reasons, or in general where conditions will not be adversely affected to any extent.

Interceptors on combined sewers for the purpose of collecting sanitary sewage for treatment, should be designed for 3 to 5 times the future dry weather average flow before overflowing. This allows for peak sanitary flows and also allows for the first storm flush, which carries the greater percentage of pollution. If storm overflows create a nuisance fine screening or settling basins should or may be, installed.

SEWER DESIGN—CAPACITY

Sewers are to be designed to carry the estimated flows 25 to 50 years in the future. Flows should be estimated at about 100 gallons per capita multiplied by the contributory future estimated population, with an extra allowance for infiltration, commercial, industrial, institutional and other special wastes. Positive information such as house to house population counts, water consumptions, gaugings and measurements are favored more than estimates.

Estimates of peak flows are also important, and when abnormal may determine at least the lateral sewer design. Commercial and industrial flows are apt to be a series of peak flows and may occur only in the day time, and coincident with the peak sanitary flows. Pre-treatment or storage may be required and the peak flows ironed out. Institutions, such as schools and hospitals, have less intensive peaks but most of the flow occurs in a 16 hour period.

Lateral sewers should be designed to carry 400 gallons per capita, or twice the estimated future domestic peak flows, plus an adequate allowance for extras when flowing full.

Main and trunk sewers, where peak flows are less intense, should be designed to carry about 60 per cent of the combined carrying capacity of the contributing lateral sewers.

Interceptors on combined sewers, when designed to carry flows stated previously, need have but a small percentage added for a measure of safety, and need not be designed to carry more than that volume.

Infiltration adds directly to the cost of the sewers, and to both the first cost and the cost of operation of the treatment plant. As it is caused by leaky joints and poor construction, the standard practice is to strictly limit infiltration by specification, or make the use of bituminous or equivalent special jointing material mandatory, especially if laid below ground water level. The use of cement mortar joints may add as much as 25 gallons per capita infiltration.

Flows from commercial sources, such as laundries and from schools, hospitals and institutions, are large and require adequate allowances, especially in the smaller sewers. Institutions require about twice the average domestic flows per capita.

Flows from industrial sources, when water consumption is large, require extra allowances, unless unpolluted wastes may be otherwise dis-

posed. It is not customary to attempt to estimate future industrial flows unless immediate expansion or building is in prospect. Future commercial flows should be estimated from general zoning plans.

Flows excluded from sanitary sewers should include storm water, surface drainage, roof drainage, cooling water, sometimes cellar drainage and if possible air conditioning wastes and unpolluted industrial wastes.

INDUSTRIAL WASTES

In line with the recent nationwide movement to clean up the waterways, state after state is passing rigid legislation to limit pollution, and to maintain certain new standards of purity with authority to enforce them. This applies to municipalities, industry and other special sources of pollution, whether or not with discharges are treated at the present time.

Where no treatment works exist, the states require preliminary reports covering all the factors affecting design of the new works, including exhaustive data on industrial and special wastes, including the character, volume, peak flows and analyses. With this information the state is in position, when giving approval to plans, to determine that the proposed type of treatment will meet its standards.

Where treatment works exist, in most cases legislation gives authority to deal only with the primary offender direct. If the offending parties or industry empty directly into the waterways, the States deal directly with them, but if they are already connected to the treatment plant, the States deal only with the municipality, deeming that correction of wastes is a municipal and not a State problem.

One state, at least, passing special legislation, very recently, authorizes direct dealings with industry or other parties as well as the municipality, when industrial or other special wastes, are discharged to an existing treatment plant, and are a cause, or contribute to pollution. The state can require industry or other parties to correct the nature of their wastes. In the opinion of the writer, this is a distinct step in advance and will save endless and delaying controversies between industry or other parties, and municipalities.

The above general authorities, apply in case the treatment works should cease to turn out a satisfactory effluent, due to an increase or change in the character of the industrial or other wastes.

The characteristics of individual wastes should be studied by the consulting engineer with a viewpoint of economy, interference with plant operation and damage to structures.

For instance simple pre-treatment of such wastes as those of canneries, packing and slaughter houses, creameries, etc., by plain settling or fine screening may prevent excessive size of plant units and reduce costs without excessive hardship on the part of industry. Other wastes from chemical and gas plants, etc. should require neutralization at the source to prevent damage to structures. Unpolluted organic wastes such as paper wastes should not enter the treatment plant, and wastes containing a high oxygen demand should have that demand satisfied at the source, and inorganic wastes also should be removed.

Should inclusion of ground garbage be contemplated, its effect upon the proposed treatment must be studied and ample allowance for same be made.

The Water Pollution Council of the Pacific North West Area has drawn up a code of "Minimum Requirements for the Control of Industrial Wastes," which has been adopted by at least one state. This code has been a joint effort of several other states and one Canadian Province. The purpose of the code is to eliminate as much industrial waste as possible by more careful industrial operation and installation of simple equipment, neither to involve much cost to the industry. By these means it is expected that pollution conditions may be so improved as to eliminate the need for further and more complete measures. If however a nuisance still exists, then industry will be required to install treatment measures to the extent necessary.

The consulting engineer should also determine wastes not to be admitted to the treatment plant, and to advise his client of all these matters and make recommendations for his information and approval.

GENERAL DESIGN—STRUCTURAL

Minimum mean velocities used in pipe line design should be at least two feet per second when flowing full or half full, and based on the Kutter formula with "N," the coefficient of roughness, not less than 0.0013. In many States use of lower coefficients are allowed in certain kinds of pipe under proper conditions. N equalling 0.0011 may be used for asbestos cement, cement lined or enamel lined pipe.

Lower velocities may be allowed in special cases, where two feet per second requires undue expense in deep cuts or cost of pumping, provided the proper provisions are provided for cleaning, flushing and inspection. This is specially true for the upper 600 feet of dead end lateral sewers. Outfalls from complete treatment works may have only nominal drainage grades, or run under a head.

Higher velocities may be required where lines are very long, giving the sewage a chance to become septic, especially where biological treatment is employed, and higher velocity is necessary in inverted siphons, combined sewers and other special cases.

Pipe Materials

Pipe materials may include all type of pipe with sufficient strength to withstand the loads imposed, and not subject to deterioration when in contact with the sewage to be handled. Concrete or metal pipe and certain types of joints are not allowed with septic or sewage of highly chemical character. Cast iron, or other suitable metal pipe, with lead or lead compound or mechanical joints, is required when within ten feet of any water main crossing, or bank of stream, and within 50 feet of any well or water supply. Sewers and water mains should be laid at least 10 feet apart and never in the same trench. Plans submitted for approval must show location of all water mains and hydrants to show that this regulation is carried out. Vitrified clay pipe with mortar joints are considered equal to cast iron, provided the pipe is properly laid in concrete.

Joints in vitrified clay pipe are generally preferred to consist of bituminous compounds poured hot, or by special premolded bituminous joints. Pipes are required in three foot lengths to limit the number of joints. Cement joints for V. C. pipe may be used, when the pipe line is above the general ground water table, or where infiltration is not a serious matter. Joints for special kinds of pipe are those recommended by the manufacturer. Where the contractor is allowed use of cement joints or where the conditions are favorable for excess infiltration, the specifications are required to limit infiltration to insure proper installation. One State requires infiltration limited to 12,000 gallons per day per mile of 18 inch diam. sewers or smaller.

Minimum pipe size is 8 in. dia. for laterals and 6 in. dia. for house connections. Minimum depth is 6 to 8 feet cover or sufficient to drain all cellars, and to avoid water, gas, storm drains and electric conduits when such are installed, or to provide ample space if installed in the future. Pipe lines should be laid on straight grade and

alignment between manholes, except in larger sizes where entrance is possible. Pipe lines in large sizes may be laid with curves having a minimum radius of about four times the diameter.

Manholes and Siphons

Manholes are required at all changes of grade, size, alignment, slope and intersections, or for possible future street sewering, and having a minimum spacing of about 400 feet on small sewers, and 500 or more on larger sewers and outfalls. Where small pipe lines increase in size, the lower pipe is to be depressed a distance of half the difference of the diameters, and for large pipe lines three quarters of the difference. At intersections where the drop is more than 2 feet, drop manholes are required. Manhole inverts are lined with half tile or carefully shaped in concrete and the concrete invert brought up to the top of the main pipe. Side inlets have easy curved channels, and the grade or drop going through the manhole is sufficient to maintain minimum velocities. Manholes are required to have tight construction to avoid infiltration with adequate C.I. frames and covers and with steps on about 15 in. centers.

Flush manholes with automatic flushing, or equivalent means to flush, are required at the ends of sewers with flat grades or having continually very low flows. No direct connections with the water supply is allowed to enter the manholes.

Lamp holes are not considered the equivalent of a manhole, but are allowed on dead ends not over about 200 feet in length, where the sewer will never be extended. Lamp holes may be allowed in very deep cut or tunnel permitting the manhole spacing to be increased and thus save the cost of some deep manholes.

Inverted siphons should consist of cast iron pipe or other pipe laid in concrete and passing under streams, depressed railroads or roadways, or for other causes. There are at least two lines of pipe properly sized and valved, so that the lines may be rotated, or some lines closed in order to preserve cleaning velocities, and are provided with means for flushing, rodding and inspection facilities, with an access manhole on each end. The pipe lines should be at least six inches in diameter, and sufficient loss of head going through the siphon should be allowed, to maintain in separate systems a velocity of at least 3 feet per second on average flows, and 5 feet per second on combined sewer peak flows.

TREATMENT BEFORE PUMPING STATIONS

Pumping stations may be auxiliary booster stations equipped with pumps or ejectors, or may be main stations located either at the treatment plant, or some distance away, pumping through mains to the plant. If located at the plant, the preferred location is after the primary settling tanks.

The force main may consist of cast iron pipe with lead or lead compound joints or other metal pipe with equally good joints, asbestos cement or properly designed concrete pressure pipe and joints. A minimum velocity of at least 2½ feet per second should be maintained.

Prior to each station some means of overflow or equivalent safeguard is installed, so that, in case of complete breakdown or power failure, cellars must not be flooded. This may take the form of overflow weirs or auxiliary power units. In combined system interceptors, generally the overflow provisions installed to take care of the surplus storm water, is sufficient. When possible, emergency outfalls should at least be screened, or in very critical locations, storage settling tanks should be provided and the settled sludge later pumped to the treatment works.

All pumps are preceded by coarse bar screening, or the sewage run through shredders to reduce the size of the large organic matter in order to prevent clogging of the pumps, unless the pumps are located after the primary settling basins, or are of a type where no protection is necessary, or where provisions are made to by-pass the coarse material and not go through the pumps, or if pneumatic ejectors are used.

Grit chambers are to be installed in all combined systems, and in separate systems where grit may be expected. They should be located before the pumps if practicable, or provisions made in the wet well to handle grit and settleable material which may accumulate. Grit chambers should precede shredders if possible, and bar screens if practicable.

Coarse screens may be of the basket or hand raked bar screen type, with proper provisions made to handle the screenings in small installations. In large installations, mechanically raked bar screens in duplicate, or where a single unit is used, a hand raked bar screened by-pass is provided. Means should be provided to cut out and dewater any unit for repairs or inspection. The screenings for small plants may be removed for disposal in closed cans, and for large plants power grinders should be provided. If the sewage is passed through shredders a by-pass channel equipped with a hand raked screen is to be provided. All screening processes are laborious, and adequate means and space should be provided for easy access, repairs, inspection and operation, and also adequate lighting and forced ventilation when below ground level.

Hand rake screens should have clear openings of 1 in. to a slope of about 30°, and a net perpendicular submerged area of 150 to 250 per cent of the area of the incoming sewer, and of 300 per cent in case of combined sewers. Mechanical screens should have clear openings of ¾ to 1 in. or larger depending upon pump and treatment plant requirements.

Grit chambers for small plants usually should be of the channel type and cleaned by hand. They should be in duplicate, 30 to 60 feet long with provisions installed to regulate the depth so as to maintain approximately a velocity of one foot per second. Space is to be provided to store two or three days collection of grit in the bottom of the channels, and the installation is to be valved in order to be able to alternate channels or to lay one out of service. A grit chamber placed in front of a Parshall flume is satisfactory with velocities well regulated.

Grit chambers for large plants should be of the channel or pit type, with mechanical equipment to remove the grit. The channels should be at least in duplicate, and have the same general provisions as for the small plants. Two mechanical units, or one unit and the other channel equipped for hand cleaning may be provided. Some cleaning of the grit takes place in the scraper conveyor action, and clear water sprays may be installed if necessary to clean the grit completely.

In the pit type, no special velocity need be maintained and organic matter is expected to settle out with the grit. Mechanical equipment should be provided to sweep or elevate the detritus from the pits, and various standard means may be provided to wash the organic matter from the grit and return it to the sewage. If the equipment can be elevated out of the pit for repairs without requiring a shut down of the plant, only one unit need be provided.

PUMPING STATIONS

Pumping stations should be so located as to be above flood levels or must be protected against flooding and be able to operate continuously. Pumping stations having a separate wet well and a separate dry well containing the pumps, are universally preferred and mandatory in many

states. If, however, the pumps are located in the wet well, provisions are made to be able to uncouple and elevate the pumps for repairs.

The wet well should be designed with sumps or a narrow channel out of which sewage is taken up in the pump suctions and as little settled matter allowed to accumulate as possible. The bottom should have slopes of about 1½ vertical to 1 horizontal to the sumps or channel, with the wet well containing about 10 to 20 minutes storage on the average flow below high water. The wet well may contain either the measuring device, the grit chamber, or the bar screen, or all three. When these units are located in the wet well, ample working space, adequate lighting and forced ventilation are necessary. Both wet and dry wells are to be entirely housed with the wet well entirely separated from the dry well with a solid partition wall which is carried up to the ceiling of the superstructure. Means of entrance and stairways are to be entirely separate, in order to prevent contact of moisture and gases from the electrical equipment and machinery.

The dry well, containing the pumps, should be drained and provided with an automatic sump pump, have ample room for access to all parts of the pumps, be well lighted and ventilated, and have stairways and necessary equipment. The superstructure above the dry well should contain the electrical and control equipment, and other apparatus pertaining to the pumping process. It may of course be part of the treatment plant and contain other equipment and treatment units. The motors may be located on ground floor or in dry well, in which case the dry well must be protected against flooding. Pump houses or control buildings are to be adequate heated, designed and equipped to conform to all safety regulations.

At least two duplicate pumps or ejectors are to be provided in all stations, each having sufficient capacity to take the entire peak flow. Where more than two pumps are provided, which is mandatory in large plants, any one pump may be a spare and the combined capacity of the other pumps should be sufficient to handle the peak flows.

Pump operation, when the station is located at or near the treatment works, should be such as to pump at the same rate approximately as the sewage enters the station. If only two pumps are provided they are provided with multi-speed motors or variable couplings to accomplish this result. If three or more are provided, one pump should have the capacity of about minimum flow and run almost continuously. The others should be proportioned to the proper size and number with some equipped with variable speed motors or variable couplings, and all automatically controlled, in order to eliminate peak flows consistent with the requirements of the treatment works.

Pumps are to be placed at an elevation giving positive head on the pumps at all times. In case however pumps do have a suction head, it should be limited to 10 feet and pumps should have automatic priming devices. Pumps may be of the non clog, single suction type, either vertical or horizontal, close coupled or with motors on the ground floor, with adequate seals and cleanouts. Pumps should have individual suction lines and be at least 4 in. diameter with inverted flare ends in the wet well and valved. The discharge lines are to be at least 4 in. diameter and have both valve and check valve.

Water supply should be furnished at all stations but if connected to float valves, meters, pumps or other equipment, there must be a break of at least 6 in. in the clear between the supply and ultimate connection. This is generally accomplished by the use of a surge tank with the service valved outlet well above the high water in the tank, and pressure should be maintained by use of small power pumps.

If serious results will occur in case of power failure, two sources of power may be provided, or gasoline driven pumping units or generator sets installed. For small stations a portable gasoline pumping unit may be provided. Automatic alarms independent of the power supply may be provided to give warning of high or low water, pumping difficulties, and power failure.

In case recirculation of sewage or sludge occurs, and is handled by the main pumps, extra capacity must be allowed.

Sewage flows should be metered at all plants and the measuring equipment located where necessary to record the flow for the purposes of proper operation. In some plants the measuring device may come before or directly after the main pumps. The measuring device may consist of weirs, flumes, venturi and flow meters, with indicating and recording equipment, and in sufficient detail to keep detailed records of various operations in the type treatment plant installed.

Electrical equipment should be selected to withstand the special hazards to which it will be subjected, such as moisture, vapor, drips, splashes, corrosive or explosive gases as the occasion may require.

Provisions should be made to allow easy removal of equipment for repairs, and spare wearing parts and standard sets of tools and accessories should be furnished.

OVERFLOWS AND BY-PASSES

Overflows and by-passes are necessary in all systems, but are subject to strict limitations to avoid indiscriminate uses.

Overflows generally occur at each regulating chamber on interceptors on combined sewers. These generally should be adjustable and their use unrestricted.

Overflows or means to prevent flooding of cellars if necessary and located before pumping stations have already been described.

By-passes should be provided around all of the various treatment plant units, except possibly the sludge digesters and Imhoff tanks, so that each can be laid out of service for cleaning and repairs, but the other units can be kept in service and the sewage at least receive some degree of treatment before discharge, even if only disinfection.

Some units, such as activated units should be protected from unusual peak flows by means of overflows discharging into the following treatment unit.

In the case of all sanitary sewers with treatment works, no general by-pass is allowed unless it is sealed, and permission is obtained from the proper authorities, to break the seal.

OUTFALLS

Outfalls should be designed with the same regulations as trunk sewers unless following a complete treatment plant when it may be designed regardless of cleaning velocities.

Outfalls may be extended into the waterway well below low water level, and should be protected against freezing, floods, erosion by currents and other hazards. If outfall from only partial treatment plants are expected to cause nuisances, some form of dispersion is required.

PROVISIONS FOR SAMPLING

Sampling provisions are necessary in all plants at strategic points in order to determine the performance and efficiency of each treatment unit. Raw sewage and final effluent sampling provisions are necessary in every plant and should be close to the metering device in order to allow weighted samples.

(The second article in this series will deal with primary sewage treatment units and will appear in an early issue.)

MODERN SEWAGE CHLORINATION PLANT*

Bronx–Hutchinson and South Yonkers in Westchester County

by

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THE Bronx-Hutchinson—South Yonkers Sewage Plant, located in Yonkers, N.Y., serves a heavily populated area of 55 square miles. It was built in 1931 by the Westchester County Sanitary Sewer Commission and is now operated by the County of Westchester, Department of Public Works, Division of Sewers; James C. Harding, Commissioner; O. F. Gerlach, Supt. of Sewers. Together with the Mamaroneck and the Sawmill—North & Central Yonkers Plants, it plays a major role in the sewage treatment program of Westchester County.

Chlorination is applied to the influent and effluent. With respect to chlorination, the South Yonkers Plant presents a rather interesting picture of how one plant has kept pace with the latest developments in the field, and put these developments into practical effect with resultant savings and economy in operation.

Original Station

Chlorination was included in the original design of the plant and was furnished by six W&T chlorinators of the visible vacuum type. Four of these machines had a daily capacity of 750 pounds each, while the remaining two were of 350 pounds capacity per twenty-four hours.

A railway siding laid directly inside the plant allowed flat cars loaded with ton chlorine containers to be placed within the building proper. An overhead crane lifted the ton containers from the car as required. Originally two one ton containers were used, both resting on a scale. Liquid chlorine flowed from the ton container in use, passed through an electric evaporator and then to the chlorinators. Chlorine solution from the chlorinators was delivered under a slight negative head through a ceramic pipe line to specially designed hard rubber diffusers installed on a slope leading from the bottom of the rack screens to the bottom of the grit chambers. In addition, final chlorination of the effluent was provided through two 3-in. hose lines, each one extending some 60 ft. down into its respective 48-in. outfall pipe.

The Author
(Between an old and a new chlorinator)

Those were the highpoints of the original chlorination layout. Like most such designs it was basically sound although various unforeseen troubles developed during actual operation that had to be overcome. For example, a very effective pressure reducing valve was installed in the chlorine gas supply lines to take care of eliminating occasional chlorine liquefaction because of chilling of the gas lines. Similarly, air binding in the chlorine solution lines was eliminated after a study showed that an aspirator would alleviate this trouble. Another step forward towards greater ease of operation and lowered maintenance costs occurred when the dual ceramic solution discharge lines were replaced with rubber lined steel pipe. Although such equipment has now become standard, it was something quite new when the South Yonkers Plant was built.

Tank Cars Used

As all these changes were gradually accomplished, it also became apparent that better use could be made of the railroad siding into the plant. Instead of using this siding for multiple unit cars each loaded with 16 individual ton containers, a change-over was made so that 16-ton tank cars could be used for the chlorine supply.

This change resulted in two major advantages, a reduction in the cost of chlorine and a saving in handling and hook-up time. For example, a single hook-up operation for the 16-ton tank car took the place of removing 16 single ton containers from the flat car and hooking them up 16 separate times.

Naturally, in changing over to the tank car supply, every effort was made to find the best and safest methods of handling such an installation. The system used at the South Yonkers Plant is perhaps one of the most practical in use today. Connections are made from one of the tank car liquid valves to a permanent liquid line leading to the evaporators and from one of the tank car gas valves to a permanent gas line leading to the low capacity chlorinators. A by-pass is used between these two connections.

Hook-up Procedure

To use this hook-up for placing a tank car in service the procedure is as follows:

1. Make up all connections securely using new gaskets in all union joints.
2. Open each of the four valves on the hook-up one turn.
3. Open the gas valve on the tank car one turn.
4. Test the entire hook-up for leaks.
5. Open the permanent gas line valve one turn and allow the line to come up to tank car pressure. Note pressure.
6. Close the valve on the liquid line side of the by-pass, also close the tank car gas valve, then draw down the pressure in the gas line to about 15 psi.
7. Open the valve on the permanent liquid line. Note pressure. Close the liquid valve on the tank car or ton container now in use.
8. Open the tank car liquid valve slowly. The pressure will rise or fall on the liquid line to the pressure of the tank car being placed in service.

In this procedure, if leaks develop at any time, by proper use of hook-up the chlorine can be drawn out of any part of the lines.

*Photographs by Norman Germond, Industrial Photographer, Great Notch Farms, N.J.

Two 16-Ton Chlorine Tank Cars on Siding Inside the Building

This entire method using the by-pass is particularly effective from a safety viewpoint. Leaks, which are as gas, are easily and quickly detected. This means that the danger of a large volume of gas immediately forming from leaking liquid is eliminated. Instead only a minute amount of chlorine gas will escape in the event of a leak and that can be quickly dissipated with adequate ventilation.

Change Over Standby

Some provision had to be made to have chlorine available when tank cars were changed. Thus, two ton containers are available on a standby basis, with one connected into the permanent liquid line at all times. This ton container is put into operation by simply opening the liquid valve as required.

Following these general rules of practice that were developed through several years of experience, and using a tank car setup with a bypass will enable safe, efficient handling of tank cars within a plant to become a reality.

Increasing Capacity

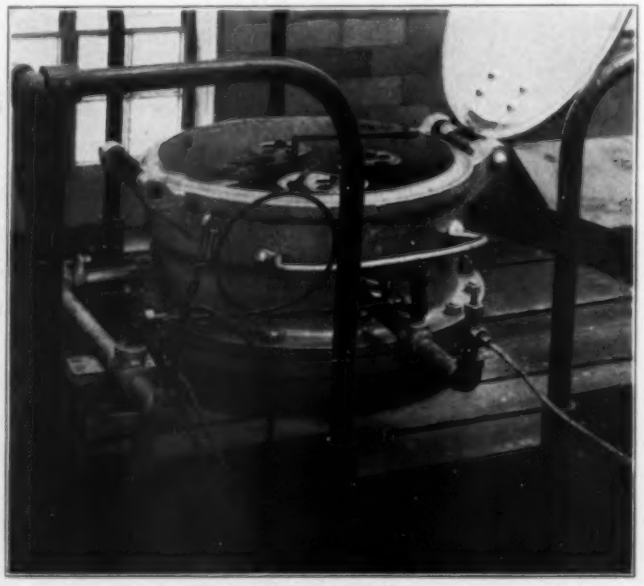
Having obtained a cheaper and easier method of handling the chlorine supply, the next step in the development of chlorination at the South Yonkers Plant was to keep up with the increasing capacity demand. To meet this increase, a new machine was installed in 1937. This was the first installation of a 2000 lb. capacity Wallace & Tiernan Master Chlorinator. Results were so good with this machine that it was made a permanent part of the installation later on in that year. With this chlorinator, plus those of the original installation, sewage chlorination requirements were fully met for several years.

As the years passed, taking their toll of the older machines, a study was made to see if these machines could be replaced by newer equipment which would result in greater savings through more efficient operation based on better design.

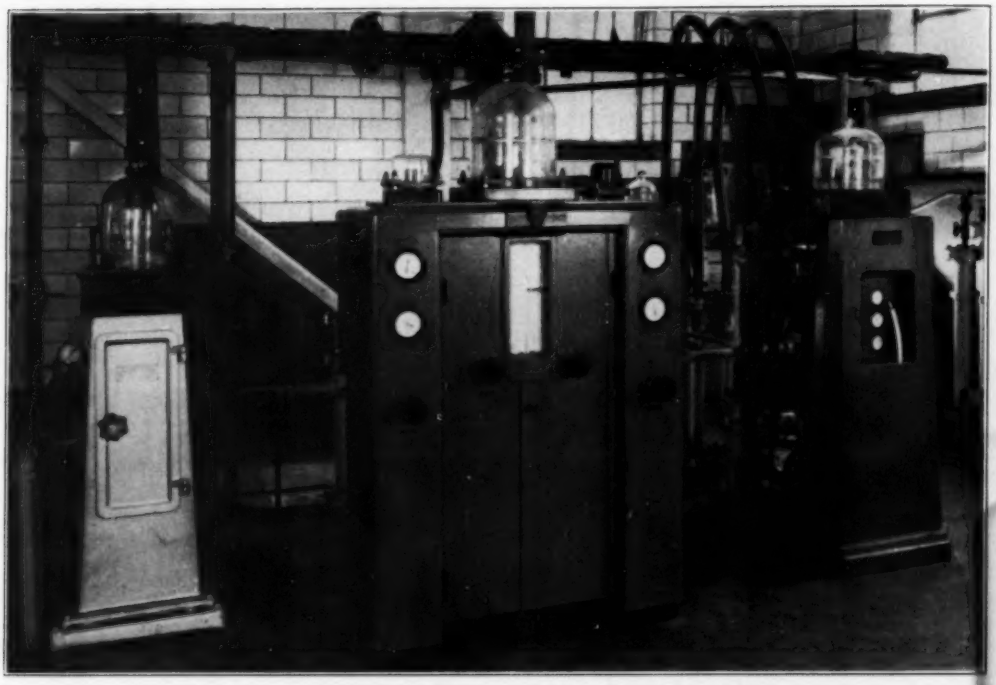
After a careful analysis of the various factors involved an air-operated W&T master chlorinator was installed on a test basis. The results have been particularly satisfactory for several reasons. The air-operated chlorinator which will handle up to a maximum of 3000 pounds daily replaced four older worn machines, making more space, and simplified the control problems. (By some modification the new machine can be increased to a 6000 pound capacity.) It was a particular help in making chlorine application more flexible, as the air master was connected to one chlorine solution line and the second solution line to the older 2000 pound machine of 1937 and the two 350 pound machines.

With such a set-up the chlorine flow can be split evenly between both lines for grit treatment as desired.

The new machine also has made for greater economies in maintenance with fewer parts and less maintenance time required. The results of the test on this chlorinator have been so successful that in addition to making this machine a permanent part



Close-up of Hook-up to Tank Cars
(Note by-pass line)



Grandfather, Father, and Young Master Chlorinator
(On the left—350 lb.; on the right 2000 lb. and in the center the new air operated W&T master chlorinator)

of the system a long range plan is in the making whereby a second air master will be installed, and the two 350 pound machines kept as trimmers, to be used to empty tank cars when their capacity becomes very low.

From this brief review of chlorination at the South Yonkers Plant the value of maintaining a progressive attitude towards new ideas and methods is evident. At the South Yonkers Plant this attitude has evidenced itself in the development of sound handling techniques—as in the case of tank cars—and in the adoption of modern equipment for chlorination. However, it should be stressed that new methods and equipment were adopted only after trial under rigorous day-to-day operating conditions had proved their worth from both an efficient and economical viewpoint.

Kentucky Accelerates Stream Pollution Abatement

With the passage of legislation establishing a state water pollution control commission in June, the State of Kentucky has accelerated its campaign to clean up the streams of that state. The new law was inspired by the participation of Kentucky in the Ohio River Compact Commission.

The new Kentucky Commission which will be headed by F. Clark Dugan, Dir., Div. of San. Engng. Ky. State Health Dept., is empowered to establish quality standards for waters in the state according to their uses and to issue orders for the abatement of waste discharges or adoption of remedial measures to curb pollution.

Pollution control activities in Kentucky will be closely integrated with the Ohio River interstate program. Three members of the new Kentucky Commission are also commissioners of the Ohio River Compact Commission.

Valuable Measuring Device

Some time ago the writer showed how to measure accurately between

two walls or objects that cannot be measured directly with a rule or steel tape. He said, in a nutshell: use two sticks such as laths or anything else that is stiff and clamp them together as indicated in the sketch. You then have the exact distance between two points—more accurate than obtained by most other methods that are in use.

A friend, however, has improved the writer's method by suggesting that one of the sticks be of *definite* length as indicated by the word "bar" in the sketch. Then if the other stick is a "rule" you can immediately find the total distance in inches. Thus if the bar is 30 inches long, and the rule reads 10 inches at the tip of the bar, the distance between the points would be exactly 30 plus 10, or, 40 inches.

To go my friend one step better, his device could be made up of three bars, two of which can be graduated, for measuring a greater variety of widths.—*W. F. Schaphorst.*

SOME FURTHER OBSERVATIONS ON THE C. O. D. TEST*

Experiments on Oxidized Effluents

by

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UPON completion of work correlating the dichromate oxygen consumed test with the first-stage oxygen demand of raw and settled sewages, the writer proceeded to the examination of oxidized effluents. A series of interruptions to the work—including a long delay in obtaining a replacement thermostat for the 20°C. incubator—resulted in publication of the material at hand in Aug. 1949.[1]

Eventually work was resumed, only to come to a complete halt upon the writer's transfer from the Fort Jackson sewage treatment plant to his present position. Since, at the time of writing, no results have been published on applications of the C.O.D. test to oxidized effluents, it was decided to release such data as are available.

Experimental Work

First efforts were made with settled trickling filter effluent (final effluent of the Fort Jackson treatment plant). Procedures used were exactly the same as those described in the previous report[1] except that the samples were sterilized for suppression of nitrification by use of acid according to the instructions of Hurwitz[2] *et al.* Settled Fort Jackson sewage was used for seed.

Table I shows the resulting wide

Table I

COMPARISON OF B.O.D. AND C.O.D.
Final Effluent—Sterilized, Seeded
(Results in ppm.)

B.O.D.					C.O.D.
3 day	5 day	Calc. 5 day	6 day	Calc. Ult.	Ult.
9.0	51		17		54
11.0	18	15.3	18	29.5	58
12.5	14		18		56
32.5	40.0		44.0		112
33.0	40.0	41.3	44.0	50.2	110
32.0	38.0		42.0		96
13.0	17.6		20.0		56
12.0	18.0	18.0	26.0	36.6	48
12.0	14.0		19.0		48

* While the studies reported here were discontinued before completion, for reasons cited in the paper, they are presented for the use of others who may be interested in the investigation of the C.O.D. test and its possible relation to B.O.D.

The Author

discrepancy between the C.O.D. and the total first-stage demand calculated from dilution procedures. After some fumbling around, it was decided to investigate the fate of the nitrogen in the samples during the dichromate reaction as a possible explanation of the difficulty.

It has been shown by various workers[3-6] that where samples consisting of raw settled sewage are involved the residue of the C.O.D. test, when alkalized and distilled as in the Standard Methods[8] Kjeldahl test, will give reliable results in determining total nitrogen. A series of analyses were run comparing the Standard Methods total nitrogen with the nitrogen in the residue of the C.O.D. test. As shown in Table II, a nitrogen value for this

Table II

COMPARISON OF KJELDAHL, NITROGEN, C.O.D. AND FREE AMMONIA
(Results in ppm.)

Free NH_3	C.O.D. NH_3	Total Nit.	S M NH_3
17	12	29	24
12	18	30	34
19	6	25	24
4	2	6	5
Aver. 13	9.5	22.5	21.8

oxidized effluent which would agree with that of the standard methods could be obtained only by adding together the C.O.D. residual nitrogen and the free ammonia nitrogen obtained by Nesslerization.

The inevitable conclusion was that the free ammonia was being ozidized

Table III

COMPARISON OF B.O.D. AND C.O.D.
(All results in ppm.)
Plant Final Effluent

Col.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	3 day B.O.D.	6 day B.O.D.	Calc. Ult. B.O.D.	Free NH_3—N	NH_3 Corr. (2.61 x Col. 4)	C.O.D.	C.O.D. Minus Corr. (6)-(5)
Ft. Jax Comp.	19.3 19.3 18.7	26.0 26.0 24.3	29.5	21	54.8	88	33.2
Ft. Jax Comp.	24.0 24.0 23.3	33.0 34.0 31.0	38.4	19	49.6	92 88 90	40.4
Ft. Jax Comp.	29.0 29.0 31.0	47.0 47.0 44.0	76.2	11	28.7	106 108 108	79.3
Greenwood Abattoir	3.9	5.6	7.0	4.0	10.4	16.0	5.6
Ft. Jax Grab.	7.5 7.0 7.5	10.5 9.5 9.5	10.2	6.0	15.7	22 22 24	6.3
Ft. Jax Grab.	8.5 9.0 8.5	17.0 13.0 14.0	23.9	7	18.3	44 38 41*	22.7
Ft. Jax Grab.	25.5 26.5 25.5	40.0 33.0 35.0	38.9	12.0	31.3	74 62 68	36.7
Average			32.0				32.0

Note:
Median values used except where marked
* average of 2 values.

by the dichromate. Since this effect probably resulted from the relatively small quantities of carbon available, it might be eliminated by reducing the reaction time. In view of possible difficulties in accurately timing the shorter reaction period, it was decided to stick to the original six minutes boiling, determine the free ammonia separately and develop a correction factor. The possibilities of using this effect to measure total first and second stage demands were not investigated.

Another series of analyses was undertaken with results as shown in Table III. After five samples had been completed the average difference between C.O.D. and dilution first-stage demands was divided by the average value for free ammonia, obtaining a factor of 2.66 for the ammonia correction. Two more samples were run which, used with the others, give a factor of 2.61—a value which might be improved with a longer series of analyses. Attempts were made in vain to correlate this figure with some equation for the oxidation of nitrogen, suggesting that a mixture of oxides was formed. Analysis of the distillate from the reaction still remains unfinished business.

Most of the analyses were done in triplicate with calculations based on the median as before, although single values would probably suffice for routine work.

Attention next was turned to a study of trickling filter effluent (not settled) with sadly scrambled results for the dilution method (Table IV). Examination of the data by the graphical methods suggested by Churchill[6] suggested that nitrification was occurring in spite of the preliminary acidification. Probably the reduced flow at the Fort sewage treatment plant at this time had made the sewage unsuitable for use as a first-stage seed. Unfortunately, the writer was then unaware of the work of Placak, Ruchoft and Snapp[7], whose procedure of adding chromate ion (2 ppm.) to the dilution water would have suppressed nitrification in the seed and well as the sample. Note that the triplicate C.O.D. values are in good agreement.

Table IV

COMPARISON OF B.O.D. AND C.O.D.

(All results in ppm.)

Filter Effluent (Not Settled)

Col.	(1)	(2)	(3)	(4)	(5)*	(6)	(7)
Sample	3 day B.O.D.	6 day B.O.D.	Ult. Calc. B.O.D.	Free NH_3-N	NH_3 Corr.	C.O.D.	Corr. C.O.D. (6)—(5)
	25	28.6				78	
1	21	37.1	50.0	14	36.5	70	41.5
	22	34.3				80	
	6	24.3**				52	
2	7	72.9	94.0	11	28.7	52	23.3
	13**	71.4				54	
	26	24				74	
3	12	37	29.7	9	23.5	80	50.5
	37	26				74	
	9	14.3				80	
4	10	14.3	22.3	11	28.7	76	47.3
	8	12.9				76	
Average			49.0				40.7

Note:
* NH_3 Correction—Free NH_3 x 2.61
Median values used to calculate Nos. 1 and 4
Arithmetical average used to calculate No. 3
**Values used to calculate No. 2

Conclusions

1. It appears probable that the form of the dichromate C.O.D. test used in these experiments will serve to readily determine the ultimate first-stage B.O.D. of oxidized effluents of sewage treatment plants if correction is made for the free ammonia content of the sample. No stiochimetric justification was found for the correction factor used, but it held good over a considerable range of ammonia content.

2. Observations on plain trickling filter effluent (not settled) were inconclusive, due possibly to poor seed quality, but the trend of the data suggests that the corrected C.O.D. values are probably valid.

Acknowledgement

The writer wishes to express his great appreciation of the cooperative attitude of George M. Speed, Post Sanitary Engineer, which made it possible for much of this and other work along this line to be done in connection with his duties as Supervisor of Sewage Treatment at Fort Jackson, South Carolina.

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Md.-Del. Water & Sewage Short School

In Mid-June, the Maryland Delaware Water & Sewage Association held a Short Course for water and sewage plant operators at the Johns Hopkins University, in Baltimore. More than 35 "students" attended the short course. The course was co-sponsored by the Maryland and Delaware State Departments of Health and the Chesapeake Section of the AWWA. Sixteen papers or demonstrations were presented. A laboratory seminar and question and review period were also held. At the end of the course, certificates of attendance were presented by President Ralph E. Fuhrman, Supt. Blue Plains Sewage Works, Washington, D.C.

Haifa to Construct Sea-Outfall

Officials of the port city of Haifa, Israel, have issued a call for engineers to aid in the design and construction of a $3,000,000 sea-outfall sewer line. The project will be headed by J. L. A. Watson, Chief Engineer, and Abraham Erlich, Drainage and Water Supply Engineer of Haifa. These two men have been in the United States to purchase necessary equipment and supplies and to interview candidates for employment as engineers on the project. Mr. Watson is a former New Zealander, who served as Chief Engineer of Haifa under the British mandatory regime and who has been retained by the State of Israel in the same capacity.

The new sewer outfall line will extend into the Mediterranean for some 900 yards. It is being financed by a recent loan through the Export-Import Bank.

WASTE TREATMENT PLANT OF THE ALAN WOOD STEEL CO.

THE Alan Wood Steel Company of Conshohocken, Pa., in complying with the Pennsylvania program for abating pollution of the streams of the Commonwealth has constructed a plant for the treatment of waters being discharged into the Schuylkill River. The system required various diversion sewers, pumping elements, an oxide concentrator and a clarifier, including a system for neutralizing the spent waste acid pickle liquors produced by the processing of strip and sheet steel. The plant was constructed in 1949 at a cost of approximately $775,000 to handle 17,000 gpm. of waste waters.

Primarily, the purpose of the system is to remove iron oxides (mill scale) and oils from the waste waters produced through cooling usage in the Blooming Mill, Plate Mill and recently installed Strip Mill.

Oxide Concentrator

After collecting the waste water from the various mills in an intercepting 36" waste-water sewer the water passes through a Parshall flume to a twin-type Oxide Concentrator, 91 ft. long x 12 ft. deep, where the heavy oxides are removed through sedimentation. Two continuous flight conveyers (speed of 2 f.p.m.), deposit the oxide sediment in boxes for easy truck removal. An oil skimming weir automatically skims the surface oil, which passes to a well, where it is removed by pumping for disposal. Effluent water leaving the Oxide Concentrator passes over two aerators to a mixing chamber, where make up water is added from the river.

Clarifier

Passing underground, the Oxide Concentrator effluent passes through a 125 ft. center-feed Door Clarifier with a depth of 13 ft. Sludge is periodically removed through pumping to a disposal area created by Alan Wood Steel Co. as an impounding reservoir or lagoon for this usage only.

On top of one rake arm of the Clarifier is an oil skimmer, which forces the surfaced oil to a receptacle for this oil, whence it is piped to the oil well previously mentioned.

For continuous operations, the Clarifier provides a retention time from 35 to 40 minutes, the clarified water being discharged through a saw-tooth weir to a collecting trough, and piped to a clear well under the pump station.

Two pumps of 8500 g.p.m. each, electrically driven by 350 h.p. motors lift 17,000 g.p.m. from the clear well and return the water, at 60 p.s.i. to the mills for reuse. A stand-by steam-turbine driven pump unit, of 350 h.p. is installed to provide water in the event of an electrical failure.

If, due to a reduction in the demand of mill water, a build-up occurs in the return water, this surplus clarified water automatically overflows in the clear well to the river, until the make-up water has been reduced to meet the mill requirements. Effective control at the pumping station has held the overflow to a minimum.

Spent Pickle Liquor Treatment

Spent acid pickle liquor is conveyed to the treatment plant through a rubber lined pipe and collected in a wooden 30,000 gallon storage tank. Waste pickle liquors from the Schuylkill Iron Works, two miles from the waste water plant, are to be conveyed by tank car and deposited in the same tank. Neutralizing of this liquid averaging 2,000 g.p.d. is accomplished through the addition of lime in a mixing chamber discharging to a sludge sump, used for collection of sludges obtained from the Clarifier and those resulting from the neutralizing of acids. Runoff water from the oil sump is also discharged to this area, and all are pumped to the aforementioned impounding site, all materials being retained in this area, and prevented from reentering the river by a rolled compact earthen dam breast 1,000 ft. long with a height of 22 ft. and averaging 125 ft. in width. Many years of future capacity are anticipated in this area.

The Alan Wood waste treatment plant was designed by Fred H. Dechant, Consulting Engr., and was built by United Engineers and Constructors, Inc., of Philadelphia at a cost of $775,000 or more.

Acknowledgment—This article is based upon information and photographs supplied us by the Alan Wood Steel Co., Conshohocken, Penna., in response to our request.

Waste-Water and Pickling-Liquor Treatment Plant, Alan Wood Steel Co., Ivy Rock, Pa.

A NATIONAL WATER POLICY

A Statement by the Joint Council of America's Engineering Professions, Directed to the President of the United States, and His Water Resources Policy Commission, and to the Congress

THERE is reason to be proud of the fact that America's engineering profession has had the courage to speak out both bluntly and pointedly against "excessive and unsound" water resources practices which it attributes to competing federal agencies and to Congressional "response to pressure and trading," and calls for a halt in further authorizations until some semblance of uniform national policy has been adopted in the matter of conservation, development and use of the nation's water resources.

In a sharply-worded report, differing drastically from the customary scientific, and often indecisive, language of the profession, a special 80-man Water Policy Committee of Engineers Joint Council, representing the country's five major engineering societies, has suggested specific remedies and pointedly reminded President Truman and his Water Resources Policy Commission, the Congress and others representing both political parties that "public money is limited in availability." In presenting the report to the President and his Water Policy Commission, the 80 prominent and qualified engineers condemned "political expediency" tactics and "exaggeration of benefits claimed" in Federal Water Projects, and warned that unless the "degradation" of the last two decades in the "application of criteria to water resources development" is halted, estimates of benefits will soon become "mere excuses for justification," not valid reasons for construction of projects.

Engineers Joint Council is an organization of the five major national engineering societies: American Society of Civil Engineers, American Institute of Mining & Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers. In matters of common interest, the Council becomes the clearing house for these organizations whose membership totals more than 100,000 engineers.

Nine task forces contributed reports comprising the basis on which the statement has been made, deploring "ambiguous, uncoordinated and conflicting" Federal policies covering power, irrigation, flood control, navigation and other water resources projects. Warning that "evaluation of such projects is a first requirement," the report attacked boon-doggling and log-rolling in stressing such items as local responsibility, need for equitable allocation of costs, and fallacy of "incentive payments" to land owners for soil conservation measures, among others.

Here are excerpts of other criticisms voiced by the engineers:

"A number of inland waterways projects are in existence today that are completely devoid of any justification. . . . The use of inland waterways as a regulatory agency to force reductions in rates on land carriers should be abandoned."

"Many immediate beneficiaries pay little or nothing toward the costs of water resources projects. There is a progressive trend toward shifting the burden onto those who bear the expense of government through taxation. Unless the development of water resources is to be permitted to degenerate into the diversion of the national income for the benefit of particular regions or classes of people for political expediency, there must be a reversal of the present trend and the acceptance of obligations."

"The public utility form of contract authorized by the Reclamation Projects Act of 1939 can be made workable and acceptable. It requires only that the Bureau of Reclamation shall recognize the obligations of public utility service and not use such contracts to implement social changes."

Of the billion-dollar Missouri Basin development, which the report asserted "was authorized by Congress in haste and without appropriate public hearings within the Basin," the engineers have said:

"From an engineering standpoint the planning and execution is almost entirely backward. Characteristics and needs were ignored in determining which agency would develop the water resources in a particular part of the Basin. Specific projects were proposed and approved without regard or consideration of their effects on the economy, transportation, local government of counties and general welfare of the people in the areas and adjacent regions of the reservoirs. Serious conflicts continue to exist in the jurisdiction of overlapping geographic projects. There is little wonder the people are unconvinced of the feasibility of navigation on the Missouri River. After expenditures of more than $230,000,000 the navigation savings are less than $4,000,000. Much dissatisfaction prevails and there is widespread misunderstanding."

Although the report does not direct itself to the activities of any particular agency, it cites the fact that the Department of the Interior, Corps of Engineers, Department of Agriculture, Federal Power Commission, U. S. Public Health Service, Weather Bureau, Coast and Geodetic Survey "and many others" are concerned with water developments in one phase or another. As the number of federal agencies involved has grown and "as these have risen in stature their overlapping functions have become increasingly striking and their competitions have become impressively expensive," the report asserts, and calls the current situation as "chaotic." Haphazard development of vital water resources was denounced by the engineers, who especially decried projects developed and constructed, and often operated, by the same Agency that originated them.

To alleviate competition between agencies which is fostered by this practice, and to safeguard the public against exaggerated intangible benefits claims as well as improper allocation of costs between general taxpayers and project beneficiaries, the report recommends creation of a board for the impartial analysis and appraisal of all federal water projects. Such a board, the report points out, would also serve to protect the public against "the present excessive and economically unsound rate of planning and Congressional authorization of developments," since the board's review and report would be "prerequisite to the authorization or appropriation by Congress of or for projects of that kind."

In support of their proposal that engineers without continuing interest in the projects be utilized to determine economic justifiability of dams and reservoirs built for flood control, irrigation, navigation, power and water supply, or any combination of these services, the engineers pointed out that today's water developments have reached a level "representing billions of dollars annually instead

of the millions per year of the period prior to 1930." As an example of the pyramiding impact of current federal policy, the report cited the fact that, "as of 1948, federal water development projects, then under construction, involved an expenditure of funds greater than those expended for all projects in all the years preceding June 30, 1947—approximately $5,000,000,000. At the same time, projects not yet under construction but already proposed by federal agencies will require about four times the amount now being expended for projects under construction."

Of the $1,800,000,000 Rivers and Harbors legislation, enacted in May by the current Congress, the engineers said:

"No one, and least of all the President, is under the misapprehension that this authorization bill is sound with respect to the wisest expenditure of public money. Every informed individual, including many of the members of both houses of Congress who voted for it, are undoubtedly aware that no inconsiderable amount of the money authorized might have provided alternative values in other areas of national development than water resources, to better advantage of the people of the United States. In addition, many of the authorizations provided in the Act were for undertakings which realistic diagnosis and measurement would disclose as neither desirable nor warranted."

Expressing "conviction that measurable quantitative criteria are essential in the common sense evaluation of water resources projects," the engineers insisted that claims of benefits in terms of "national welfare," "national defense," "the general good," etc., etc., "should be explicitly identified and separately considered."

Urging that water resources development "should, wherever feasible, be by local enterprise—governmental or private," the committee warned:

"Collective action through the medium of the Federal Government is justified only for two purposes—to do those things essential to national defense or otherwise of substantial benefit to all the people throughout the nation, or to aid in financing construction cost of works for the benefit of a limit number of people on terms equitable to all other citizens of the nation."

Other recommendations included:

Authorization of Federal water projects should be solely by Congress.

There should be no further authorization until a uniform National Water Policy has been developed and adopted.

So far as practicable, projects should be self-supporting.

Authorizations should serve as an absolute limit on appropriations, and should not be in blanket form.

The Congress should review any substantial change in project, and authorizations should become void if the project cost overruns by 20 percent the cost estimated at time of authorization.

Policy of general applicability for use in connection with all functions of Federal water resources development sould be prescribed for use by all agencies.

Adequate time should be allowed for collection of essential data and for determination of whether there is real need for the proposed development.

Expenditures on water projects should be at a lower rate during periods of general prosperity and at a greater rate during periods of reduced business activity and employment.

Benefits should be expressed in average annual monetary terms and strictly compared with average annual costs.

The Government, "and hence the nation's taxpayers," should be reimbursed by beneficiaries for benefits accruing directly to them. Where there is subsidization, "there should be complete disclosure in all details, beginning with the initial reports recommending the development for authorization by Congress." And, all subsequent reports, including annual reports, should be equally revealing.

Appraisal of costs should be realistic, as should the distinction between estimates and actual expenditures.

Standard criteria of economic justification are spelled out in the report to be used as yardsticks for measuring, and from time to time "realistically" reappraising, benefits and costs and the division of the latter on multiple-purpose projects.

Water Supply and Pollution

Of principle interest to the readers of *Water & Sewage Works* will be that portion of the Committee Statement which quotes the general conclusions presented by Task Committee No. 1 charged with reporting on "Domestic and Industrial Water Supply and Pollution," and headed by Louis R. Howson as Chairman and Linn H. Enslow as Coordinator. These are:

A—The use of water resources for domestic and industrial purposes is believed to be the highest and best use. Without adequate water supply properly safeguarded against pollution, urban life cannot exist.

B—The use of water resources for domestic and industrial purposes is also the only universally distributed use. In this respect it is unlike irrigation or hydroelectric or flood detention which are limited in area of development.

C—Although nation-wide in development, domestic and industrial water supply present essentially local community problems. Of the 13,000 public water supply systems serving 85,000,000 people in the United States with approximately 15,000,000,000 gallons of water per day nearly all are intrastate. Only a few have interstate problems and a very limited number are concerned with more than two states.

D—Urban or private industrial water supplies should accordingly be built and paid for by those using the service. The cost of water from public supplies, which is usually less than 2c per capita per day, is within the economic reach of all.

E—Since the domestic and industrial water supplies are of such prime importance it necessarily follows that pollution of water resources must be so controlled as to make it practicable to provide a water of satisfactory quality as well as adequate in quantity.

F—Pollution of water should be regulated at the lowest governmental level adequate for the particular situation. Some will be wholly local, some at state level and some at state compact level. Federal jurisdiction and participation should be limited to the administration of existing laws; to research, investigation and guidance upon which sound state laws and local regulations may be based, with as much uniformity as is consistent under the variable conditions encountered.

G—On dual or multi-purpose projects involving public water supply, the local community should pay its fair proportion of the cost and the project only then be carried forward if the remaining part of the cost to be provided from federal funds has a proper cost-benefit ratio.

The Coordinating Committee points out in connection with public water supplies that, contrary to general public belief, there is no experience basis for the fear that the availability of water resources, surface or underground, is declining. Shortage of water is neither universal nor increasing. Synchronization of development and of use on occasion has been inadequate. Declining underground water levels prevail in some areas, with excessive ground water rises in others. On a national scale, however, there is little evidence to support the prophets of doom in the water resources field. Intelligent husbanding and allocation are the keys to the future.

In order to develop priority of use, one can never evade the various regional characteristics. With the exception of the first priority, naturally to be accorded to water for domestic purposes, the order of other uses generally would and should be regionally or locally determined.

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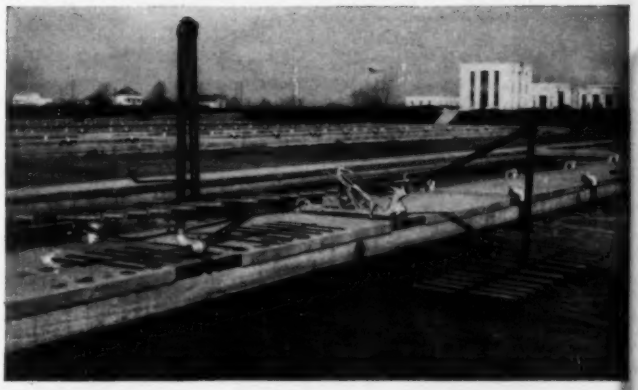

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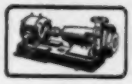

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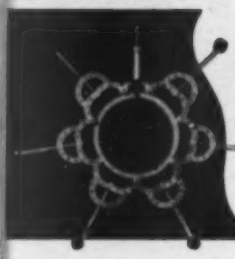

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MEETINGS SCHEDULED

AUG. 9—MT. DESERT ISLAND, ME.
Maine Water Utilities Assn. (Summer Meeting) Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

AUG. 21-23—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators Assn. Sec'y, Prof. Robert E. Stiemke, Dept. of Engineering, State College, Pa.

AUG. 23-25—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage & Industrial Wastes Assn. Sec'y, B. S. Bush, Penna. Department Health, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 6-8—ST. PAUL, MINN. (St. Paul Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 518 Metropolitan Life Bldg., Minneapolis, Minn.

SEPT. 7-8—UPPER SARANAC LAKE, N. Y. (Saranac Inn)
New York Section A.W.W.A. (Fall Meeting) Sec'y, R K. Blanchard, 50 West 50th Street, New York, N. Y.

SEPT. 11-13—LAKE OF BAYS, ONTARIO (Big Win Inn)
Canadian Institute of Sewage and Sanitation. Secretary, Dr. A. E. Berry, Parliament Building, Toronto, Ont.

SEPT. 13-14—HUNTINGTON, W. VA. (Hotel Pritchard)
W. Virginia Section A.W.W.A. Sec'y, J. B. Harrington, State Department of Health, Charleston, W. Va.

SEPT. 14-15—HUNTINGTON, W. VA. (Hotel Pritchard)
West Virginia Sewage and Industrial Wastes Assn. Sec'y, R. G. McCall, Room 643, State Capitol Bldg., Charleston, W. Va.

SEPT. 18-21—POLAND SPRING, ME. (Poland Spring House)
New England Water Works Association. (Annual Convention Sec'y, Joseph C. Knox, 1204 Tremont Bldg., Boston, Mass.

SEPT. 19-21—OSHKOSH, WIS. (Raulf Hotel)
Wisconsin Section A.W.W.A. Sec'y, L. A. Smith, Supt. Water Department, Madison, Wisc.

SEPT. 19-21—DAVENPORT, IOWA (Hotel Blackhawk)
Iowa Sewage Works Association. Sec'y, Leo Holtkamp, E. Ohio Street, Webster City, Iowa.

SEPT. 20-22—ATLANTA, GA. (Georgia Institute Technology)
Georgia Water and Sewage School. Sec'y, Van P. Enloe, R.F.D. No. 5, Box 363, Atlanta, Ga.

SEPT. 24-26—CALGARY, ALBERTA (Palliser Hotel)
Western Canada Water and Sewage Conference. Sec'y, H. C. Lindsten, 301 Hamilton Bldg., Winnipeg, Manitoba.

SEPT. 26-29—ATLANTIC CITY, N. J. (Claridge Hotel)
Pennsylvania Water Works Association. Sec'y-Treas., C. M. Hartman, 510 Telegraph Bldg., Harrisburg, Pa.

SEPT. 27-29—SANTA FE, N. M. (LaFonda Hotel)
Rocky Mountain Sewage Works Association. Sec'y, C. H. Coberly, Room 329, 1441 Welton St., Denver, Colo.
Rocky Mountain Section A.W.W.A. Sec'y, Geo. J. Turre. Room 120, City-County Bldg., Denver, Colo.

SEPT. 28-29—COLUMBUS, OHIO (Neil House)
Ohio Section A.W.W.A. Sec'y, L. T. Fawcett, Box 298, Youngstown, Ohio.

OCT. 1-3—ST. LOUIS, MO. (Sheraton Hotel)
Missouri Section A.W.W.A.
Missouri Water & Sewage Conference. Sec'y, Warren Kramer, State Office Bldg., Jefferson City, Mo.

OCT. 4-6—BISMARCK, N. DAKOTA
North Dakota Water & Sewage Works Conference. Chairman, Edward J. Booth, City Engr., Bismarck, N. D.

OCT. 9-12—WASHINGTON, D.C. (Statler Hotel)
Federation of Sewage Works Association. Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

OCT. 11—WATERVILLE, ME.
Maine Water Utilities Assn. (Marks the 25th Anniversary of founding of the Ass'n.) Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

(*Continued on page* 86A)

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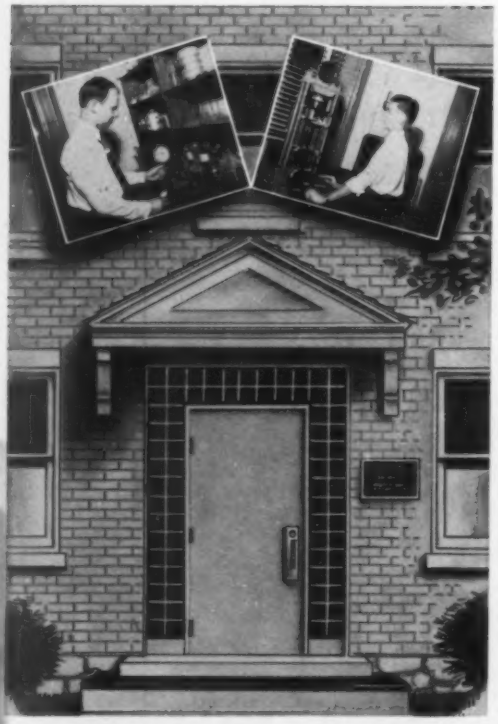

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MEETINGS SCHEDULED

(Continued from page 84A)

OCT. 11-13—MOBILE, ALA. (Battle House Hotel)
Alabama-Mississippi Section A.W.W.A. Sec'y, J. L. Snow, 601 First National Bank Bldg., Montgomery, Ala.

OCT. 15-18—NEW YORK CITY, N.Y. (Hotel New Yorker)
American Public Works Association Congress. Exec. Director, Donald Herrick, 1313 East 60th St., Chicago 37, Ill.

OCT. 15-18—NEW ORLEANS, LA. (Roosevelt Hotel)
Southwest Section A.W.W.A. Sec'y, Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 16-18—PITTSBURGH, PA. (Hotel Wm. Penn)
Engineers' Society of Western Pa. Chairman, W. J. Murdoch, Hotel Wm. Penn, Pittsburgh, Pa.

OCT. 18-20—PITTSBURGH, PA. (Roosevelt Hotel)
Pennsylvania Section A.W.W.A. Sec'y, Myron G. Mansfield, 1312 Park Bldg., Pittsburgh, Pa.

OCT. 23-25—CHARLESTON, S.C. (Hotel Fort Sumter)
Southeastern Section A.W.W.A. Sec'y, T. A. Kolb, 433 Wade Hampton Bldg., Columbia, S. C.

OCT. 23-25—MEMPHIS, TENN. (Hotel Peabody)
Kentucky-Tennessee Section A.W.W.A. Kentucky-Tennessee Industrial Wastes & Sewage Works Assn. Sec'y, R. P. Farrell, 420 Sixth Ave., N., Nashville, Tenn.

OCT. 24-27—SAN DIEGO, CALIF. (U.S. Grant Hotel)
California Section A.W.W.A. (Annual Meeting) Sec'y, Wm. W. Aultman, Box 38, LaVerne, Calif.

OCT. 25-26—SPRINGFIELD, ILL.
Illinois Water Works Operators Association. Sec'y, John Briggs, Ass't. Supt., Freeport, Ill.

OCT. 25-27—DETROIT, MICH. (Detroit Leland Hotel)
Michigan Section A.W.W.A. Sec'y, T. L. Vander Velde, 2609 E. Saginaw St., Lansing 12, Mich.

OCT. 26-27—DES MOINES, IOWA (Fort Des Moines)
Iowa Section A.W.W.A. Sec'y, H. F. Blomquist, City Water Works, Cedar Rapids, Ia.

OCT. 26-28—ATLANTIC CITY, N.J. (Hotel Madison)
New Jersey Section A.W.W.A. Sec'y, C. B. Tygert, P. O. Box 178, Newark, N. J.

OCT. 30-NOV. 3—ST. LOUIS, MO. (Hotel Statler)
American Public Health Association. Exec.-Sec'y, Dr. Reginald M. Atwater, American Public Health Ass'n., 1790 Broadway, New York, N.Y.

NOV. 1-3—WILMINGTON, DEL. (DuPont Hotel)
Chesapeake Section A.W.W.A. Sec'y, C. J. Lauter, 5902 Dalecarlia Place, Washington 16, D. C.

NOV. 6-7—RICHMOND, VA. (Jefferson Hotel)
Virginia Section A.W.W.A. Sec'y, W. H. Shewbridge, 713 State Office Bldg., Richmond, Pa.

NOV. 13-15—DURHAM, N.C. (Washington Duke Hotel)
North Carolina Section A.W.W.A. and North Carolina Sewage Works Association. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N. C.

NOV. 12-15—FT. LAUDERDALE, FLA. (Governor's Club Hotel)
Florida Section A.W.W.A. Sec'y, Marvin R. Boyce, 504 Pennsylvania, Clearwater, Fla. (Joint Session with) **Cuban Section A.W.W.A.** Sec'y, L. H. Daniel, Baratillog 9, Havana Cuba (and) **Florida Sewage Works Association.** Sec'y, Perry Teeple, P. O. Box 210, Jacksonville, Fla.

NOV. 16—BOSTON, MASS. (Hotel Statler)
New England Water Works Assn. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

NOV. 30-DEC. 2—TUCSON, ARIZ. (Hotel Pioneer)
Arizona Sewage & Water Works Association. Arizona Section A.W.W.A. Sec'y, Mrs. Helen Rotthaus, State Dept. of Health, Phoenix, Ariz.

DEC. 13—BREWER, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Winthrop, Me.

DEC. 21—BOSTON, MASS. (Hotel Statler)
New England Water Works Assn. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

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Two sizes: ¼-yd. 2-ton H-2 and ⅜-yd. 3-ton H-3. Send the coupon for full details.

Hydraulically Operated Clamshell
equips the city's Hydrocrane for excavating shale on a 36-in. valve chamber setting job. Outriggers extend and retract in seconds from operator's station.

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin

Other Departments
use the crane, too. Here it sets a 60-ft. roof truss into place. Operation is extremely simple — hand levers only, no foot controls.

BUCYRUS ERIE HYDROCRANE BSHSO

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin
Gentlemen: I want more information on the time and money saving possibilities of the Hydrocrane.

Name.....

Company.....

Address.....

City..... State.....

May we assist you, sir?

If you're on a merry-go-round about handling air or gas, *R-C dual-ability* can help you.

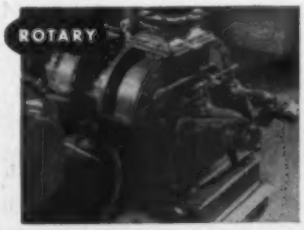
That's been our exclusive job for almost a century. We've developed the most extensive line of blowers, exhausters and gas pumps in the industry, with capacities from 5 cfm to 100,000 cfm.

We're the only builders offering that *dual choice* of both Centrifugal and Rotary Positive equipment. Thus, without bias, we can suggest units that meet most closely the requirements of the work to be done.

For new installations or replacements, look to us for your needs. Alert engineering teams up with modern construction to insure long-time, satisfactory performance of R-C equipment.

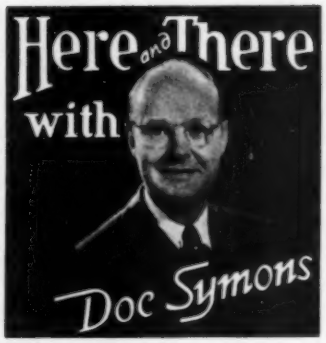
ROOTS-CONNERSVILLE BLOWER CORPORATION
508 Mount Avenue, Connersville, Indiana

One of three Type H, 3-stage Centrifugal Blowers in large sewage disposal plant. Capacity 13,000 cfm, driven by 700 hp electric motor.



Type HD Rotary Positive Blower in sewage disposal work. Variable capacity from 491 cfm to 1,000 cfm. Motor driven.

ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES



H.T.M.A.—And now the silly season is also here—The silly season when our lovely ladies can be seen on the beach in a halter and G-string and on the formal dance floor with little more, but we poor males are not properly dressed unless we are completely swathed in shirt, tie, and coat.

How unscientific can we get, when wrapping no less than a dozen layers of cloth around our necks, we shut off all possible chance for a ventilating draft around our bodies—Phooey on a belt around the waist too.—And still there are those who want us to wear a hat in the summer.

* * *

For those of you who have read the story of Harry Faber's hat, (see June column) here's a footnote—a letter from Ellis A. Tarlton, Cons. Engr., Danbury, Conn.—to wit: "Dear Doc—You sound, in your column in the June issue, just like a hat conscious member of the hat city of the world—Danbury. More power to you. As the more hats people wear—the more hats we have to make in Danbury—and the more water they use to make hats and the more they need yours truly to squeeze more of said water out of our very interesting(!) treatment facilities.

"We are very glad to hear that Harry Faber once had a hat. When he was here with some of the boys, we had to smuggle him in the back way due to his hatless state. All our factories display signs—'Salesmen not wearing hats will not be received.'—Cordially, Tarlton."

* * *

If you didn't read the July issue of this column, then the following two letters won't mean anything to you, unless you happened to participate in the bridge tournament held in Charles (De Laval Pump) Coleman's rooms at the Philadelphia Convention. That July column contained a report on that tournament as written

(*Continued on page* 90A)

check list of applications of *calgon** in preventing scale

a.	Addition of Alkali to Hard Bicarbonate Waters	1. Ammonia treatment of irrigation water (for fertilization) 2. Ammonia absorption systems (by-product coke plants) 3. Internal boiler water treatment with soda ash (feed line deposits particularly in case of wayside treatment of locomotive boiler water) 4. Caustic and hypochlorite bleach tanks (paper mills)
b.	After-Precipitation Following Lime-soda Softeners	1. Municipal water systems 2. Boiler feedwater treatment
c.	Application of Heat to hard Bicarbonate Waters	1. Single pass heat exchangers, condensers, and cooling jackets 2. Domestic water heaters
d.	Evaporation and Heating in Recirculating Cooling Systems	1. Power Plants (low temperatures) 2. Air-conditioning systems (low temperatures) 3. Oil refineries (high temperatures) 4. Metallurgical furnaces (high skin temperatures)
e.	Commercial Evaporation	1. Multiple-effect evaporators, for syrups and liquors (sugar and paper mills)
f.	Miscellaneous	1. Subsurface brine disposal in "flooding" operations 2. Pump suction 3. Barometric condensers 4. Producing oil wells

For more detailed information on the use of Calgon in preventing lime scale, fill out and mail the coupon below or write us concerning specific problems in which you are interested. Calgon technical representatives are at your service.

Calgon, Inc.
Hagan Building, Pittsburgh 30, Pa.

Please send me a copy of your bulletin, "Calgon Prevents Lime Scale."

Name.....
Position.....
Company.....
Street and Number.....
City.....Zone.....State.....

*T.M. Reg. U.S. Pat. Off.

HAGAN HALL BUROMIN CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PA.

(*Continued from page 88A*)

by Mr. Coleman, himself. As I indicated when I printed the report there was some disagreement with the way Mr. Coleman wrote it. The first criticism came from E. A. (Siggie) Sigworth, the Nuchar Man of New York City. "Sig" wrote: "Dear George (That's V. T. Y.): I have just now received a copy of 'Charlie' Coleman's letter of May 31, addressed to you on the general subject of the bridge tournament at the Philadelphia AWWA Conference. I hereby wish to stress that I do not consider the writer of that letter qualified in any way to arrive at the conclusions stated in his report. Just to give you an example of the confusion existing in his mind, my copy of that letter to you was addressed to me in care of the West Virginia Pulp and Paper Co., 317 City Hall, Richmond 19, Va.

"Fortunately, the letter got into the hands of Marsden C. Smith, my pal, my buddy, my friend, who saw that the letter was properly re-addressed to me here in New York City. It is difficult for me to understand the confusion which could result in mail addressed to me from Trenton having to be routed through Richmond.

"I also wish to register my objections to the aspersions cast on my many friends in the water works field. I still maintain that Marsden C. Smith was the only one of the contestants who is a bona fide author of a bridge book, and therefore logically should be at the top of the heap. Unfortunately, Charlie Coleman does not elucidate on the background of one John A. Caton, so that it is difficult to determine his real bridge abilities. I would just like to know whether this John A. Caton has ever authored a book on how he plays bridge.

"Furthermore, I object to being put into the class of the better players simply because I was fortunate enough to have had lousy partners at Philadelphia. As you know, some of the fellows such as Harry Krum, Harry Lendall, Mike Glace and George Naylor have been feuding at the bridge table for a number of years and how one individual can set himself up as judge and jury on the qualifications of such excellent players is beyond my comprehension.—Sig."

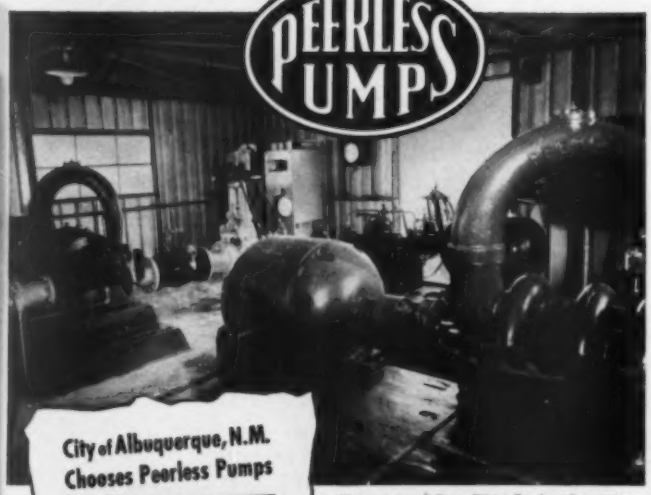
* * *

And then this letter came a few days later from Ivan Maxwell (Mike) Glace, Cons. Engr. of Harrisburg, Pa.—"Dear Doctor: Since just before and after the recent AWWA Convention at Philadelphia, considerable correspondence has crossed my desk about a matter that has no importance whatsoever and which should not be allowed to take up the time of a busy engineer. You will understand that is why I am taking time to forward the following comments. First, I should like to know who was responsible for the idea of posting official records for and against those persons who gathered in the rooms of the De Laval Co. in Philadelphia for a little free diversion. Such procedure was certain to lead to controversy such as now rages. The person responsible certainly should be barred from further proceedings at similar future conventions.

"I give Mr. Coleman credit for being an able pump designer, but I agree with Mr. Sigworth that his qualifications for analyzing the bridge tournament records are decidedly open to question. Some of his adjectives particularly, are in bad taste, such as, 'better,' 'fairly well,' and 'terrific strain.' This is in direct contrast with Mr. Sigworth's letter, in which he states 'some of the fel-

(*Continued on page 92A*)

"PEERLESS PUMPS PREFERRED"



City of Albuquerque, N.M. Chooses Peerless Pumps

Read what Mr. Chas. Wells, City Manager, City of Albuquerque, says about Peerless Pumps:

"We buy all our equipment on the basis of evaluated performance, features of construction and necessarily from the best manufacturers in their respective fields. In the expansion of our water facilities necessitated by the phenomenal growth of our city, we needed much new pumping equipment. The Peerless pumps shown were selected for their excellent characteristics of performance and favorable evaluated bid price."

Signed: *Chas. Wells*
City Manager
City of Albuquerque, New Mexico

Photo shows 2 Type TU-14 Peerless Pumps installed for the City of Albuquerque, New Mexico . . . each pumping 325 gpm, at 378 Ft. T.D.H.

Follow the lead of hundreds of progressive communities who are standardizing on Peerless Pumps for all community water services, including water supply from deep wells, booster station service, cooling tower service and sewage and waste disposal service. Descriptive and illustrated bulletins are available on all types of Peerless Pumps. Plan with Peerless for all your needs for pumps.

Plan with Peerless for pumps for all these services:

Booster Recirculation Stations
Municipal Water Supply
Steam Plants
Cooling Tower Services
Sewage Disposal
Storm Water Disposal
Fire Protection
Flood Control

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORP.
Factories: Los Angeles, California and Indianapolis, Indiana • *Offices:* New York; Atlanta; Fresno; Los Angeles; Chicago; St. Louis; Phoenix; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.

PIPE CLEANING TOOLS AROUND the WORLD

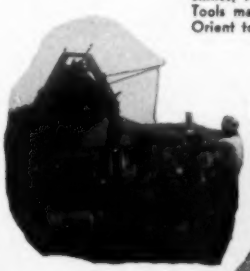
OSLO, NORWAY—SINGAPORE, M. P.

★ All this debris taken from 10" pipe. Section shows perfect job.

WATER LINES

★ "Flexible Power Bucket Machines, Power Drive Rods and Tools make work easier in the Orient too.

SEWER LINES



"FLEXIBLES" IN OSLO AND SINGAPORE—AS WELL AS IN THE U. S. A.

"FLEXIBLE"

UNDERGROUND PIPE CLEANING CO. — **SEWER-ROD EQUIPMENT CO.**

9059 VENICE BOULEVARD, LOS ANGELES 34, CALIFORNIA

141 W. Jackson Blvd., Chicago, Ill. — 401 Broadway, New York 13 — 147 Hillside Ter., Irving, N. J. — P. O. Box 165, Atlanta — P. O. Box 465, Memphis, Tenn. — 801 E. Excelsoir Blvd., Hopkins, Minn. — 29 Cordon Ave., Roslindale 31, Mass.

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THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. — P. O. BOX 14

MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—
Nation Wide Service—30 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

(Continued from page 90A)

lows such as . . . Mike Glace and . . . such excellent players.' Also for the record, I should like to ask when, in baseball for instance, the total number of runs scored over a series of games is given as an indication of the best team. I have always been under the impression that teams are rated on the number of won and lost games. Your personal examination of the record in Mr. Coleman's possession will give you an entirely different opinion as to who were and are the better players participating in that tournament.

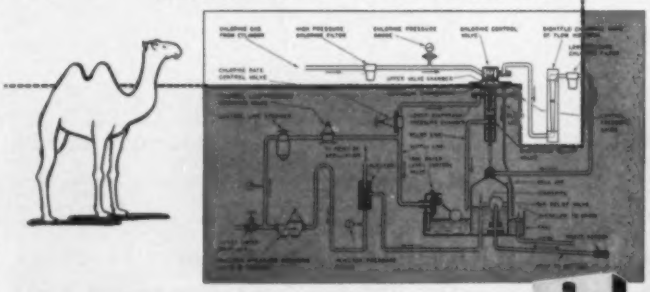
"I know personally that John Caton, who won every rubber in which he took part, has played very little bridge until recently. This is either an indication of his great brilliancy at bridge or reversely, an indication of the abilities of his opponents in the other direction.

"I trust that any further correspondence in this matter will be confined to Trenton and will not be distributed as widely as has been done prior to this time. Very truly yours, Ivan M. Glace."

Any one else want into the discussion?

The DRY ZONE

MAKES THE BIG DIFFERENCE!



No wet chlorine in vital control parts

BUILDERS CHLORINIZERS control and meter chlorine gas in the dry, non-corrosive state. Dry, non-corrosive gas as it comes from the cylinder is regulated, controlled, and metered before it enters the bell jar where it first comes in contact with water. As a double protection, the chlorine control valve is lined with porcelain enamel and has a Tantalum diaphragm with silver valve seat and needle — materials that are completely unaffected by dry chlorine gas and highly resistant to moist chlorine gas.

Here is another of the many extra features of BUILDERS CHLORINIZERS. Be sure to get these features on your new and replacement chlorinators by specifying BUILDERS. For Bulletins and engineering information, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, Rhode Island.

Model DVS

Model CVS

BUILDERS PRODUCTS

The Venturi Meter • Propelaflo and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyaflo Meters • Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Chlorinizers — Chlorine Gas Feeders • Filter Operating Tables • Manometers • Chronoflo Telemeters

BUILDERS—PROVIDENCE Instruments

130 YEARS 1820 BUILDERS 1950 BUILDERS IRON FOUNDRY

Out Chicago way, last April, I snapped a couple of shots I didn't have space for in the report on that meeting. Here for example, you see four fellows, well known in my old

home state. Harold E. Babbitt, Prof. of San. Engr., Univ. of Ill.; J. J. Woltman (AWWA Director), Cons. Engr., Bloomington; W. J. (Bill) Downer, Asst. Chief Engr., Ill. State Dept. of Health, and A. M. (Buzzie) Buswell, Chief, Ill. State Water Survey.

And then here's a homey shot of the new Ill. Section Secretary "Les" (U.S. Pipe) Hart and that cute girl of his, to wit: "Liz."

Report from Ohio—Just before I sat down to write this stanza, I went down to Cincinnati to the meeting of the O.S.&I.W.T.C.—That gave me the chance to renew acquaintances with "Jim" Nicklis, The Columbus W & T man and former Buffalonian and alumnus of Canisius College. Jim's Flo couldn't make it; been having some trouble with Iridiocylitis (you pronounce it) but thanks to ACTH and Cortezone, she is seeing well again.

Jack Wirts, once again Supt. of the Cleveland Easterly Plant, reported his Isabel as quarantined with the kids. (See you in Washington, "Norsky".)

Among other things I discovered in Cincinnati—Ed (Ohio River Compact) Cleary is rated as a real gone guy on the accordion, and Judy Le Bosquet (Maurice and Hope's eldest —he's the USPHS Field Director out of Cincinnati) has a marvelous talent for making personalized design of Christmas cards by the silk screen printing method. If you want

(Continued on page 94A)

It's EASY with PRECALKED

CAST IRON PIPE

NO Runners to Make
NO Jute to Use
NO Lead to Melt
NO Joints to Pour

All the joint materials are placed in the Pipe Bells at the foundry. Life long red wood wedges and pure lead are positioned in the pipe bells ready for calking. You Simply "Socket the Spigot and Calk."

All Sizes 2" thru 12" cast in 18-ft lengths

CAST IRON SUPER-DELAVAUD

McWANE CAST IRON PIPE CO.
Birmingham 2, Alabama

Member of a Great Pump Family

There is a PUMP by Aurora for every pump job.
TYPE-OD
Aurora Horizontally Split-Case, Double Suction, Single Stage Centrifugal Pump.
For general water supply for municipalities, industries, office buildings, institutions—also—for handling liquids, chemical solutions, oils etc., in a wide variety of industries. Write for Bulletin 105-M for further details.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS — **AURORA PUMP COMPANY**

68 Loucks Street, AURORA, ILLINOIS

Now you can machine TRANSITE PIPE on the job with PILOT MACHINING TOOL

Now a simplex coupling can be used at any point where pipe is cut. Save time in the field and utilize all odd lengths.

Duplicate factory machining in the field or shop on asbestos—cement pressure pipe with this specially engineered hand tool—for all pipe classes through 8" nominal (10" O. D.)

Shipping weight 17 lbs.
List price . . $78.00
freight added

Ask about the new Model 4 Pilot Pipe Cutter. Saves time—money. Easy to use . . . *fast*—*accurate*.

at your supplier or write:

PILOT *Manufacturing Company*
420 MARKET STREET · SAN FRANCISCO 11 · CALIFORNIA

Distributors wanted. Write for details.

Electroforged into one piece *for STRENGTH*

Self-cleaning · Easily Maintained · Maximum open area · Simple to cut and bend for fitting around obstacles · Adaptable to many uses.

Blaw-Knox Electroforged Stair Treads available with rolled diamond checker plate nosing, twisted crossbar nosing or abrasive nosing.

and SAFETY

NON-SLIP — the twist does the trick • Maximum safety and strength . . . that's the ideal combination in Blaw-Knox *electroforged* Steel Grating. Each individual joint is electrically forged together in a union stronger than the surrounding metal! The twisted bar construction gives a firm grip on shoe soles, makes slipping impossible.

WRITE FOR BULLETIN 2396

BLAW-KNOX DIVISION of Blaw-Knox Company
2051 Farmers Bank Bldg., Pittsburgh 22, Pa.—Offices in Principal Cities

BLAW-KNOX ELECTROFORGED STEEL **GRATING**

(Continued from page 92A)

something very unique in Christmas cards, write Judy at 8 Sheldon Close, Mariemont, Cincinnati, Ohio. Better write now as she has a stack of orders ahead of her.

* * *

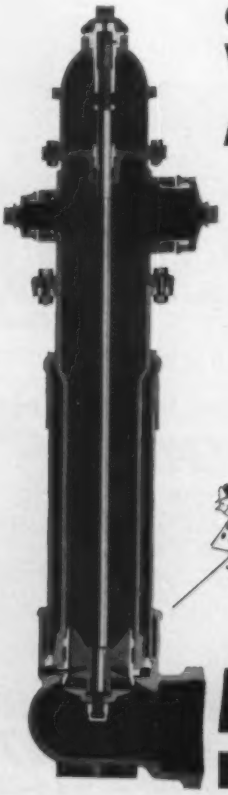
While I think of it, I want to thank those readers who sent me copies of last year's October issue in response to my plea this past spring. Seems I promised them the postage. —Miss Ryan, send a couple of stamps to each of the fifteen with my thanks.

Memo to Myself—"Don't let it go to your head!" In Nov., 1946, I was mentioned in *The Pipe Line*, published by the N. J. Section AWWA, and edited by Ann E. Body (whom I suspect is really Charlie Capen, Chief Engineer of the Wanaque, N. J. Water Commission); in Oct., 1948, I was mentioned in the *Ohio Section News*, published by that Section and edited by Ferd P. Fischer, that skilled lapidary (and W & T Dist. Mgr.) of Cleveland; and now just recently, I was mentioned in *Sanitary Engineering News*, published by Purdue University Civil Engr. Dept., and edited by Prof. Don E. Bloodgood; he of the famous Purdue University Industrial Waste Conferences.

* * *

Hope you have—or had—a good vacation—V.T.Y.

—Doc.



COMPRESSION-TYPE VALVE PREVENTS LEAKAGE AND FLOODING

Traffic accidents are a problem to consider in buying fire hydrants today. What happens when a hydrant is the loser in an argument with a 10-ton truck? Your community can rely on the Mathews Modernized Hydrant to make the best of a bad job. Rest assured there will be no flood damage to cause law suits. Its compression-type valve prevents leakage—and replacement takes only a few minutes. Depend on Mathews, the leader for more than three-quarters of a century.

MATHEWS HYDRANTS

Made by R. D. Wood Company
Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

THE FIREMAN'S FRIEND

Mathews Modernized Hydrants Set the Pace: Easily maintained, because simple in construction • All working parts contained in replaceable barrel • Stuffing box cast integral with nozzle section • Head can be turned 360° • Replaceable head • Nozzle sections easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for extra strength, toughness, elasticity • Operating thread only part to be lubricated • A modern barrel makes an old Mathews good as new

MANUFACTURERS' and EQUIPMENT NEWS

801
Cushioned Check Valves

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has just developed a "Cushioned" Swing Check Valve for preventing back flow. Operating by means of inlet pressure against a check disc, these valves prevent return of water whenever inlet pressure decreases below delivery pressure.

Featuring an exterior air cushioning cylinder, these valves may be adjusted for cushioning at any desired point in the stroke. The easily accessible lever is weighted in the closed position, and it may be adjusted for faster or slower closing. Golden-Anderson Swing Check Valves are made of cast iron or cast steel, with bronze or stainless steel seat ring and non-corrosive cushion chamber.

To obtain further information regarding this "Cushioned" valve, use a Reader Service Card, entering the key number above and your name and address.

Mrs. E. H. Ford Dies
Widow of Founder of Ford Meter Box Co.

Mrs. Elizabeth Neff Ford, widow of Edwin H. Ford, founder of the Ford Meter Box Co., died at her home in Wabash, Ind., on June 30. Mrs. Ford was 80 years old at the time of her passing and had always had a great interest in the Ford Meter Box Co. from the time of its founding. After the death of her husband, the business was carried actively forward by her four sons, Holton N. Ford, of Hamilton, Ohio, Wilbur E. and John

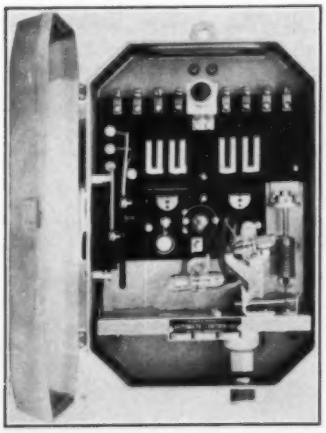
L. Ford of Wabash, Ind., and Richard V. Ford of Haddonfield, New Jersey.

Mrs. Ford had spent her entire life in Indiana and all but 20 years of it in Wabash County, where she has resided since 1911. She was active in the local library board, the War Mothers of World War I, the Round Table, and The Methodist Church. Mr. and Mrs. Ford were married in Oct. 1891, and he preceded her in death in 1933. She is survived not only by her four sons, but also three brothers, one sister, 12 grandchildren, and one great grandchild.

802

Pump Protecting Unit

Protectorl, a new control by Automatic Control Co., prevents damage to pumps caused by their running



without discharging water. Protectrol automatically stops the pump and prevents starting until manually reset, in event of mechanical failure, lowering of the water table, or any other cause for water not being discharged. Emergency condition causes unit to energize audible alarm circuit, light warning light, and is equipped with alarm silencer and automatic reset.

To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

Proportioneers' Herb Hollberg Dies

Herbert E. Hollberg, Vice President, %Proportioneers, Inc.%, Providence, R.I., died suddenly at his home in Cranston, R.I., on July 1.

A native of Sweden and a graduate electrical engineer of the University of Sweden, Mr. Hollberg came to this

FOR DEPENDABLE FLOW CONTROL...

Specify KENNEDY Iron-Body Double-Disc Gate Valves for Water Service

Check your Valve requirements against this handy chart: NOTE: 3" thru 48" are all A.W.W.A. Standard

TYPES OF VALVES AVAILABLE—Non-rising Stem and Outside Screw & Yoke

Connections Available	2"—6"	8"—14"	16"—24"	30"—60"
Bell Ends	Yes	Yes	Yes	Yes
Screwed	Yes	Yes	No	No
Flanged	Yes	Yes	Yes	Yes
Mechanical Joint	Yes	Yes	No	No
Universal	Yes	Yes	Yes	30" only
Transite	Yes	Yes	Yes	30"-36" only
Spigot Ends	Yes	Yes	Yes	Yes
Combination Ends	Yes	Yes	Yes	Yes
Accessories Available	**2"—6"**	**8"—14"**	**16"—24"**	**30"—60"**
Rollers for Horizontal Operation			Bronze on bronze track	Bronze on bronze track
Stem and Stem Nut	Manganese Bronze 60,000 lb. Tensile strength	Manganese Bronze 60,000 lb. Tensile strength	Manganese Bronze 60,000 lb. Tensile strength	Manganese Bronze 80,000 lb. Tensile strength
By-Pass			available	available
Spur Gears			available	available
Bevel Gears			available	Standard
Gear Cases			available	available
Electrical Control	available	available	available	available
Cylinder Control	available	available	available	available
Square Bottom		available	available	available
Indicator	available	available	available	available

WRITE FOR BULLETIN 59

LOW PRESSURE VALVES CAN BE FURNISHED IN THE ABOVE TYPES, SIZES AND ACCESSORY EQUIPMENT. WRITE FOR DETAILS.

THE KENNEDY VALVE MFG. CO. 1036 EAST WATER ST. ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

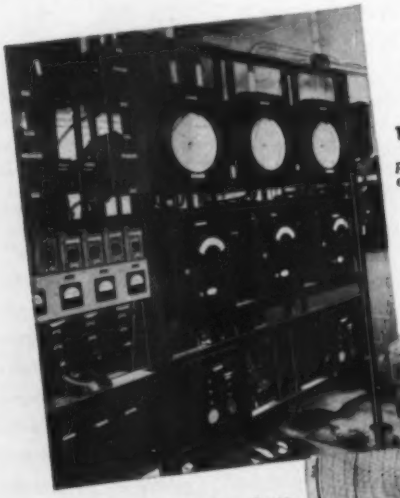
OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

WESTINGHOUSE solves critical waste disposal problem with FOXBORO pH Control

When the Westinghouse plant in Beaver, Pa., was being planned, it was realized that the waste from plating tanks would run as high as 80,000 gallons of acid solution and 25,000 gallons of cyanide solution per day. Disposal of these wastes constituted a critical problem.

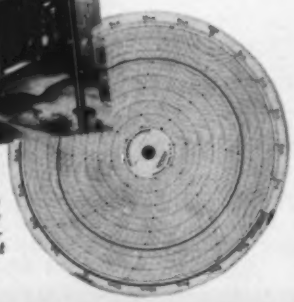
CYRUS WM. RICE & CO., INC., was retained to analyze the problem and design a treatment plant. A Foxboro pH Control System was specified to maintain optimum pH for cyanide reduction as well as proper pH of the effluent. The outstanding control which resulted is shown on the chart below.

This Westinghouse installation is only one example of the many types of industrial waste problems which have been solved with Foxboro pH Control. Whatever your waste disposal problem, Foxboro Instruments properly applied can be counted on to reduce both initial investment and operating costs. Talk it over with your nearest Foxboro representative, or write **The Foxboro Company, 228 Neponset Ave., Foxboro, Mass., U. S. A.**



1. Central control panel including Foxboro Dynalog* pH Controllers—heart of this outstanding installation.

*Reg. U S Pat Off.



2. Typical 24 hour pH record taken at weir to the sewer. Notice the uniformity of record—indicating control of effluent within 1/10 of a pH unit.

FOXBORO pH CONTROLLERS

REG U S PAT OFF

country at the end of World War I.

Familiarly known as "Herb," Mr. Hollberg joined %Proportioneers% in 1933 in Chicago shortly before

that company moved to Providence as an associated subsidiary of Builders Iron Foundry. In 1934, he went to Sweden as his firm's European representative. He returned in 1938 as export manager for the company and in 1943 was made vice president of the corporation.

At the time of his death, Hollberg was 51 years of age and was in charge of the sanitary engineering division of the company which manufactures chemical proportioning equipment.

Mr. Hollberg is survived by his wife and son of Cranston and his parents and two sisters in Sweden.

803

Combined Pipe Locator and Leak Detector

Goldak Co., Glendale, Calif., has perfected the "Dualtronic," a device for both pipe locating and leak locat-

ing. This device was developed in order to meet the increasing demand for a multipurpose electronic instrument. It has been subjected to many months of rigid tests in the company's electronic research department.

Easily adapted for both pipe locating and leak detecting, the "Dual-

tronic" is easy to handle, light in weight, and inexpensive to operate. By doing the work of two instruments it saves time, money and storage space.

For further information regarding this dual purpose instrument, use a Reader Service Card on which is entered the above key number and your name and address.

J. L. Kennedy Appointed V.P. Kennedy Valve

J. Lawrence Kennedy has been elected Vice-president and secretary of the Kennedy Valve Mfg. Co., Elmira, N.Y. He has also been elected to the board of directors of the company.

Before joining the Kennedy organization in 1949 Mr. Kennedy was Vice-president of Charles L. Rumrill & Co., Rochester, N.Y., advertising agency.

804

Prepo Torch Fuel

Pressure Products Corp., Chicago, Ill., has introduced a self-pressurizing fuel for flame tools and small

appliances, packaged in a seamless throwaway container much the same in size as an ordinary beer can.

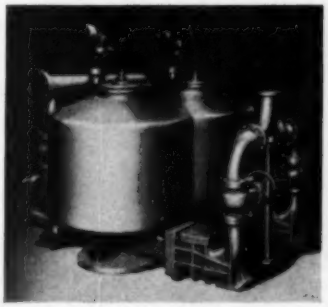
The new fuel is called "Prepo" and is designed to be used with the "Prepo" hand torch, which lights instantly, without pouring, pumping or priming and burns with a clean, blue flame of more than 2200 degrees.

An unusual feature of "Prepo" is that, like "bottled gas" it cannot be poured from the container, for there is no way the container can be opened. A rubber valve mounted on top of the container permits it to be

Good reasons why they are your best buy
FOR EVERY MUNICIPAL INSTALLATION

SHONE® PNEUMATIC EJECTORS

FOR HANDLING CRUDE SEWAGE AND SLUDGE • IN SEWAGE LIFT STATIONS
IN SUBWAYS • IN MUNICIPAL SEWAGE TREATMENT PLANTS



These far-sighted communities wanted the best, chose Shone Ejectors for recent installations:

Daytona Beach, Fla. (6)
Los Angeles, Calif., Hyperion Treatment Plant (2)
Campus, University of Washington, Seattle (2)
Chicago, Ill., West Side Subway Extension (22)
Osceola, Iowa
Mt. Clemens, Mich.
Freeport, L. I., New York (6)
Port Washington, L. I., New York (2)
Moorehead, Minn., Treatment Plant (6)
Anacostia Treatment Plant, Washington, D. C.

A few of hundreds of older Shones operating as efficiently and dependably as ever:

Long Beach, Calif.
Ft. Lauderdale, Fla.
Pensacola, Fla.
Silver Springs, Fla.
Dublin, Ga.
LaPorte, Ind.
Warsaw, Ind.
Cedar Rapids, Ia.
Davenport, Ia.
Sioux City, Ia.
Hays, Kans.
Salina, Kans.
Winnsboro, La.
Aberdeen, Md.
Baltimore, Md.
Brighton, Mich.
Detroit, Mich.
Flint, Mich.
Pontiac, Mich.
Royal Oak, Mich.
Tawas City, Mich.
Faribault, Minn.
Winona, Minn.
Brookhaven, Miss.
Butler, Mo.
Rolla, Mo.
Bloomfield, Nebr.
Manchester, N. H.
Auburn, N. Y.
Olean, N. Y.
Rochester, N. Y.
Berea, O.
Dayton, O.
Enid, Okla.
Tulsa, Okla.
Providence, R. I.
Memphis, Tenn.
Austin, Tex.
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√ no wet well
√ no noxious fumes or odors
√ no danger of explosion
√ no screens or shredders -- no repulsive cleaning job

For 75 years, in hundreds of municipal installations around the world, Shone Pneumatic Ejectors have been a symbol of utter dependability.

You may have heard the amazing story of the Shone Ejector sealed in its pit for more than 20 years—never inspected because it was not listed among mechanical equipment; rediscovered when alteration work opened the pit—operating as rhythmically and quietly as the day it was installed.

MINIMUM MAINTENANCE

Shone Ejectors require **no attention.** They can be operated from distant compressors — and several can be operated from a single compressor plant.

•

Write for Bulletin 4004—contains Air Volume and Pressure Table, sizes, dimensions, air piping layouts and other comprehensive specifications.

Use the coupon—for convenience.

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PUMPS FOR BUILDINGS, MUNICIPALITIES, INDUSTRIAL APPLICATIONS—
and a complete line of Sewage and Waste Treatment Equipment

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Chicago 22, Illinois

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Please send your Bulletin 4004.

Name_____
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...Good water

No question about it; the most popular beverage of all is good drinking water—water that tastes right, smells right and looks right.

And there's no reason for water not to be "right." Where Welsbach Ozonating equipment is used, consumers know the pleasure of drinking water free from disagreeable chlorinous odors, offensive "medicinal" tastes and objectionable color.

The biggest Ozone installation in the world (serving the Belmont filtration area in Philadelphia) proves that through Welsbach, cities can get the most efficient type of water treatment at a cost that's kind to the taxpayers.

• • •

Everybody wants improved drinking water—and all communities can now have it. Water technicians, city officials and consulting engineers particularly will be interested in the Welsbach-Ozone story. They are invited to write about their water difficulties to The Welsbach Corporation. A frank, factual analysis will be made—at no cost or obligation. Also ask for, "Are Bathless Thursdays Really Necessary?", the picture story booklet about the Welsbach-Ozone process and equipment.

THE WELSBACH CORPORATION
Ozone Processes Division
1500 Walnut Street, Philadelphia 2, Pennsylvania

attached to a mating fixture on the torch or other appliance. The container of fuel becomes the fuel tank of the appliance until empty, when it is quickly removed, thrown away and replaced by a new one.

To obtain further information on this new fuel, use a Reader Service Card on which is entered the above key number and your name and address.

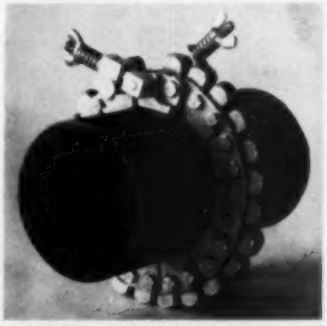
G-E Motor Driven Peerless Pumps for New York's 100 MGD. Hudson River Pumping Station

General Electric will supply six 2500-hp. vertical synchronous motors to power six Peerless pumps to be installed at the new Hudson River Pumping Station being built by New York City's Board of Water Supply at Chelsea, N.Y. Five of the pumps will be used to meet the 100-mgd. rated capacity while the sixth will be held as a spare. G.E. also will furnish a package unit substation for the project, including a steel station structure.

805

New C. I. Pipe Cutter

Robert C. Coburn, East Hartford, Conn., has designed a new Cast Iron Pipe Cutter. This new cutter enables



one man to cut C.I. pipe in considerably less time than ordinarily required. Tests have shown that with this cutter a 3 in. C.I. pipe can be severed with approximately 21 blows of a hammer and the average time consumed was slightly less than 1 minute. On a 4 in. pipe it was found that approximately 30 blows with a hammer were necessary to sever the pipe and the average time was slightly over 1 minute.

The cutter consists of a series of individual chisels attached to each other in chain fashion. This chain is put around the pipe and held tight-

(*Continued on page* 99A)

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READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(Continued from page 98A)

ly to the pipe by means of simple and dependable wing-nut clamps. Ample room has been provided for striking the chisels when clamp is tightened. All steel used has been hardened for long and constant use.

To obtain further information regarding this new pipe cutter, use a Reader Service Card on which is entered the above key number and your name and address.

Calgon Appoints Daugherty Res. Dir.

Dr. Thomas H. Daugherty, assistant director of research for Calgon, Inc., Pittsburgh, has been named director of research.

He replaces Dr. Everett P. Partridge, who has been appointed director of Hall Laboratories, Inc., an associated firm in the Hagen Corp. group.

D. J. Erikson, Hagen president, announced that Dr. Daugherty will be in immediate charge of research and development projects, particularly development work in the application of "Calgon" a sodium phosphate glass, and other products of the company in various uses.

Dr. Daugherty received the B.S. degree in chemical engineering at Carnegie Institute of Technology in 1929, and the Ph.D. degree in chemistry at the University of Pittsburgh in Feb., 1934. He joined the company in June 1934.

806

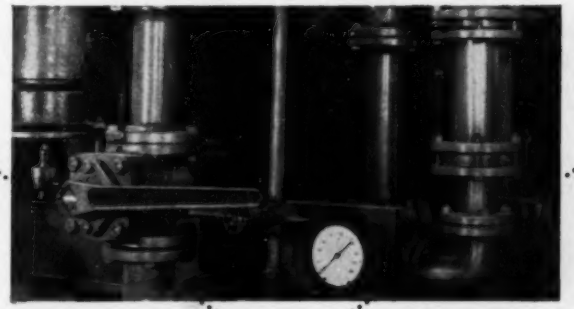
Long Term Corrosion Prevention

Metallizing Engineering Co., Inc., Long Island City, N.Y., has announced a new Metco System for Corrosion Prevention. This new technique prevents rust on tanks, bridges, fabricated steel products, etc., for 25-50 or 100 years.

The Metco Systems provide pure zinc or aluminum coatings properly treated to withstand various corrosive conditions. The applications of these metallized coatings are not limited in thickness. The size or location of the tanks or structures is not a limiting factor.

SARAN LINED steel pipe

combines the corrosion resistance of saran with the strength of steel pipe for longer term operation



Put these two advantages of saran lined steel pipe to work for you! Excellent corrosion resistance plus rigidity and pressure strength—advantages that are important in the reduction of shutdowns and lost production. The ease with which saran lined pipe is field fabricated—involving NO costly delays or special tools—makes it well worth investigating.

When planning for use of saran lined pipe, it is advisable to contact Saran Lined Pipe Company for recommendations on your particular problem.

Saran lined steel pipe is available in lengths of 10 feet and in sizes from 1 to 6 inches. Also available are flanges, fittings and valves. Manufactured by The Dow Chemical Company, Bay City, Michigan, distributed by Saran Lined Pipe Company, Dept. TSP-45.

Distributed by

Saran Lined Pipe Company

701 STEPHENSON BUILDING • DETROIT, MICHIGAN

Offices in: New York • Boston • Philadelphia • Pittsburgh Chicago • Tulsa • Indianapolis • Houston • San Francisco Los Angeles • Portland • Cleveland • Denver • Seattle Charleston, S. C. • Toronto

SARAN LINED PIPE

DOW

product

YOUR PIPE DREAMS COME TRUE WITH

CARLON

The first real pipe that is plastic!

For a first time, the features of **flexibility, light weight** and **absolute corrosion resistance** are combined in one pipe that has been developed to solve water and sewage transmission problems.

Because of CARLON'S flexibility, lightweight and corrosion resistance, longer service life is assured . . . shipping costs are minimized . . . fewer fittings are required . . . and long lengths of pipe can be installed rapidly and easily at low cost. CARLON pipe will curve to follow ditch line or surface contour. In many applications, one man can lay long sections of CARLON pipe without additional aid, and then make connections in as little as 2 minutes each.

Your pipe dreams become a reality when you SPECIFY CARLON PLASTIC PIPE. Write today for complete catalog, or call BRoadway 1-6565 for immediate service.

Specify the Pipe with the Stripe!

CARLON "CP" PIPE

NOM. PIPE SIZE	O.D.	I.D.	EST'D B.P. P.S.I.	WT. PER FT.	NORMAL SHPG. LENGTHS
½"	0.840	0.622	540	0.103	400 ft. coils
¾"	1.050	0.824	330	0.140	400 ft. coils
1"	1.310	1.070	280	0.181	200 ft. coils
1¼"	1.660	1.380	200	0.267	200 ft. coils
1½"	1.900	1.610	200	0.320	250 ft. coils
2"	2.378	2.070	170	0.443	200 ft. coils
2½"	2.875	2.469	170	0.68	200 ft. coils
3"	3.504	3.070	163	0.91	100 ft. coils
4"	4.304	4.030	150	1.25	25 ft. str.
6"	6.630	6.070	115	2.23	25 ft. str.

Identification Stripe: WHITE—Standard Pipe; RED—Heavy-duty Pipe

CARLON CP

CARTER PRODUCTS CORPORATION

10132 Mooch Avenue
CLEVELAND 5, OHIO

For many conditions the life of the protective coatings can be enhanced by specific organic treatments, provided with Metcoseal coatings. The Metcoseals are firmly keyed to the zinc or aluminum and in themselves provide years of protection. When the Metcoseals finally weather away you still have the protection afforded by the pure zinc or aluminum—both anodic to the steel, and providing electrochemical protection. Metco system 110 is used for protection of parts immersed in salt water or fresh water where the pH is above 6.5 and is especially applicable to the inside of water storage tanks. System 111 is used if the water has a pH value of 6.5 or less.

Metco system 112 provides the lowest cost application. In this system pure zinc is applied and treated with Metcoseal CR — (Chlorinated Rubber). For external applications Metcoseal Color coats may be applied in a range of five colors.

For further information regarding these Metco Systems, mail Reader Service Card showing the above key number and your name and address.

Caterpillar Helps Win Winnipeg Flood Fight

Caterpillar Tractor Co., Peoria, Ill., through their Winnipeg dealer, the Powell Equipment Co., Ltd.,

Diesel electric set for powering 10 mgd. pump is installed behind pumping station.

played a significant role in combating the devastating flood that recently swept Winnipeg.

In one instance a Caterpillar D397 Electric Set was rushed from Peoria, Ill., to Winnipeg in less than 30 hours to serve as standby power at the city's Water Pumping Station. Canadian Customs allowed the engine to come through without regular paper work because of the emergency. This 314 KW set powered a huge pump capable of supplying 10 mgd.—enough for the city's drink-

ing water consumption and fire protection.

Powell Equipment Co. remained on 24 hour duty for three weeks to

Caterpillar powered pump aids flooded sewer

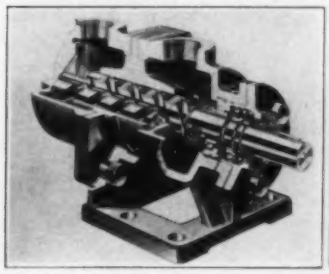
supply and service the tireless crew of diesel-powered machines, which, according to city and army officials, were indispensable. Caterpillar diesel operated pumps also pumped out flooded sewers.

Killeen Co. to Represent Hammond Iron Works

Hammond Iron Works, Warren & Bristol, Pa., has announced the appointment of the T. F. Killeen Co., Buffalo, N.Y. as their Western New York State representative. For the past half-century Hammond Iron Works have been known as designers, fabricators and erectors of steel storage tanks of cone roof, breather, sphere, spheroid, floating roof and vapor-lift design, and also gas holders, elevated water tanks, steel and alloy plate work.

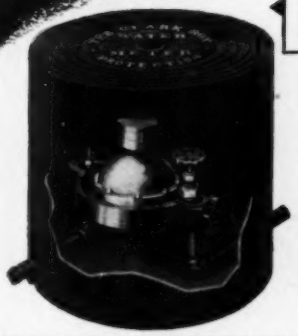
807 Low Cost IMO Pump

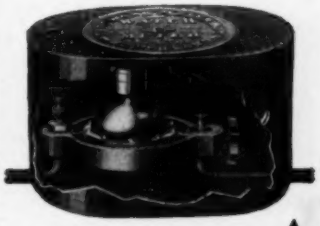
De Laval Steam Turbine Co., Trenton, N.J., has introduced a new De Laval—IMO Series A313A pump that has been especially designed for



CLARK METER BOXES AND COVERS

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.





Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

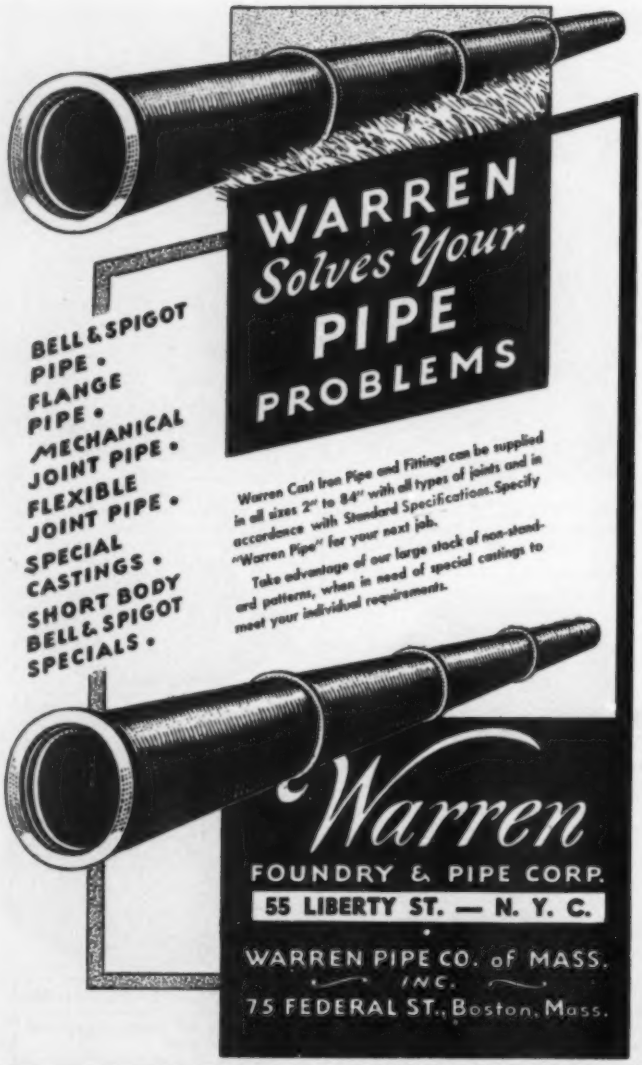
Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

write

H. W. CLARK CO.

MATTOON, ILLINOIS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Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE • FLANGE PIPE • MECHANICAL JOINT PIPE • FLEXIBLE JOINT PIPE • SPECIAL CASTINGS • SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
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FOUNDRY & PIPE CORP.
55 LIBERTY ST. — N. Y. C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

Since 1886

"Ebony Paint Kills Rust"

A Refined Coal Tar Base Paint

No matter how old the job—5 to 25 years—rust has never been found under EBONY PAINT.

Specified by many Engineers for Sewage Disposal and Water Plants.

Quart sample and literature on request.

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DARLEY MAGNETIC DIPPING NEEDLE $17.50

with 3 section telescoping handle $22.25

Write Today for 48-Page Catalog

W. S. DARLEY & CO., Chicago 12

economical, standardized quantity production.

Because of its compact design, the De Laval—IMO A313A requires little space, and the fact that it can be direct-connected to its driver also is a space-saving feature. All parts are interchangeable. The mechanical seal requires no attention. The pump can be mounted in any desired position. Suction can be located at top, bottom, horizontal left or right.

To obtain further information regarding this low cost pump, use a Reader Service Card entering the key number above and your name and address.

Bartlett of Hooker Co. Elected Director NICB

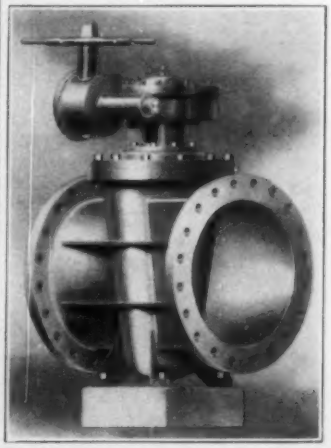
E. R. Bartlett, President, Hooker Electrochemical Co., was re-elected Director of the National Industrial Conference Board for a term of one year at the 34th Annual Meeting held May 18th in New York City.

Founded in 1916, the Conference Board is an independent, nonprofit organization devoted to the testing, distribution and explanation of business and economic facts essential to developing and setting management, labor and governmental policy. More than 3,000 businesses, unions, libraries, colleges and government groups support the work of the Board.

808

Shut-Off Valve

S. Morgan Smith Co., York, Pa., has developed a positive acting shut-off valve. This plug stop valve was developed to meet the need that exists in the water works and sewage fields.



Designed with a reduced area cone it provides a valve that is reasonable in price, positive in action and easy to operate under both normal and emergency conditions. This valve is the result of exhaustive research on the torque and hydraulic characteristics of various models to determine the most advantageous design.

To obtain further information regarding this new valve, use a Reader Service Card entering the above key number and your name and address.

Diepenbrock Joins Marlow Pumps

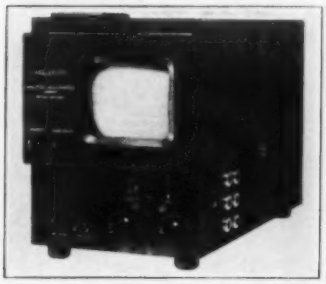
Marlow Pumps, Ridgewood, N.J., has announced the appointment of J. B. Diepenbrock as District Sales Representative for the West Coast.

Mr. Diepenbrock, formerly associated with Ingersoll Rand and Dow Chemical, will take charge of Marlow Municipal Pump Sales in Calif., Oregon, Wash., Idaho, Nevada, Arizona, Western Montana and Utah.

809

Analyzer

Analytical Measurements Inc., Chatham, N.J., has developed an instrument called the "Analascope" that provides a convenient, dependable



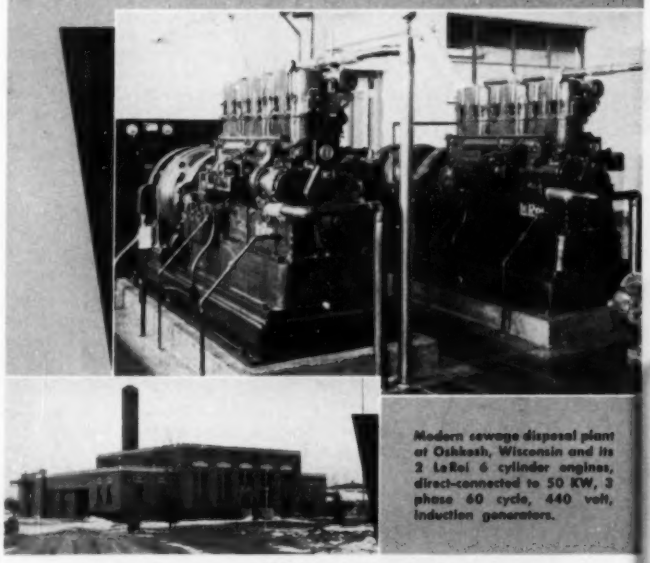
means for measuring and continuously showing any phenomena that can be translated into electrical impulses.

Its possibilities as a tool of general utility in the laboratory can be appreciated from the fact that one moment it can serve as a pH meter which measures to .001 pH, and the next moment it can serve as an electrocardiograph, a pressure indicator, or a strain analyzer. Results are displayed on the long persistence screen of a 5 in. cathode-ray tube which is an extremely flexible, indestructible indicator.

To obtain further information regarding this new instrument, use a Reader Service Card on which is entered the above key number and your name and address.

LE ROI MILWAUKEE

Saves 6 times initial cost in 12 years of continuous service!



Modern sewage disposal plant at Oshkosh, Wisconsin and its 2 LeRoi 6 cylinder engines, direct-connected to 50 KW, 3 phase 60 cycle, 440 volt, induction generators.

Here's proof that Le Roi Engine Generator Sets save taxpayers' money!

In Oshkosh, Wisconsin, two Le Roi engine-generator units operating on "no-cost" sewage gas produce electric power at a cost of .398¢ per kwh. This extremely low cost includes charges for labor, insurance, depreciation, and repairs. Purchased power at the utility rate would be 1.507 cents per kwh. Using Le Roi results in actual savings of nearly $4000 a year for taxpayers!

Lubricating oil, repair parts, and labor cost less than $600 a year for these two twelve-year-old engines. This is real evidence of Le Roi long-life and dependability.

Le Roi engines are available in sizes ranging from 6 to 600 hp — custom generator sets in sizes from 30 to 300 KW. They operate on no-cost sewage gas, natural gas, butane, or gasoline. Lighten the tax load in your community. Investigate the advantages of Le Roi low-cost power. Send the coupon below for a detailed report of this and other money-saving installations.

LE ROI COMPANY

Milwaukee 14, Wisconsin

New York • Washington • Cleveland • Birmingham
Milwaukee • Tulsa • Butte • San Carlos

LE ROI COMPANY MILWAUKEE 14, WISCONSIN

Please send me complete information on the Oshkosh, Wisconsin Le Roi Engine installation plus other cost-cutting job reports.

Name.....

Title.....

Address.....

City.....(...) State.....

Tear out this coupon and mail TODAY!

E-67

Easy To Install
MECHANICAL JOINT

Features include: (1) Fast and easy installation, (2) unskilled labor, (3) construction economy, (4) Joint deflection, (5) leak-tight. We furnish Standardized Mechanical Joint Valves, Hydrants and Cutting-In Sleeves. WRITE FOR CIRCULAR 49.

M & H PRODUCTS INCLUDES

FIRE HYDRANTS
GATE VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES AND VALVES
CHECK VALVES
FLOOR STANDS
SPRING LEVER CHECK VALVES
EXTENSION STEMS
ELECTRIC MOTOR OPERATED VALVE
SHEAR GATES
MUD VALVES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
S & S FITTINGS
CUTTING-IN TEES
HYDRAULIC OPERATED VALVES

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

Hendrickson Joins Amer. Concrete Pipe Assn.

The American Concrete Pipe Assn., Chicago, Ill., has announced the appointment of John G. Hendrickson to the staff of the Association as Research Engineer.

Mr. Hendrickson, a native of Cranbury, N.J., graduated from Princeton University. He was associated with the American Bridge Co. and Princeton University before he entered the Civil Engineering Corps of the U.S. Navy in 1943. Discharged in 1946, after being awarded the Silver Star, he returned to Princeton as an instructor in Civil Engineering and at present is an Assistant Professor in Civil Engineering. Mr. Hendrickson will be located at the headquarters of the American Concrete Pipe Assn. in Chicago.

Builders Iron Foundry in Canada

BIF Industries of Canada, Limited, a subsidiary of Builders Iron Foundry, Providence, R.I., was formed early in June for the manufacture of certain products made by Builders-Providence, Inc., and Omega Machine Co. In particular, BIF Industries of Canada, Limited, will produce Venturi meters, flow controllers and gauges, Chlorinizer gas chlorine feeding apparatus, and Omega gravimetric and volumetric chemical feeders.

Sales of all of these products in Canada will continue to be handled by Keith Mercer, Reg'd., 1100 Craig St. East, Montreal 24, Quebec; Control and Metering, Ltd., 454 King St., West, Toronto 2B, Ontario; and Bayfield and Archibald, 448 Seymour Street, Vancouver, B.C.

BIF Industries of Canada, Limited, will be located at 454 King St., West, Toronto 2B, Ontario, Canada.

810

Rohm & Haas Announce Monobed Deionization

Rohm & Haas, Philadelphia, Pa., has announced a basic advance in ion exchange processing, involving intimate mixtures of anion and cation exchangers in a single bed of resins.

The new process, whose various forms are termed Amberlite Monobeds, is described as offering to water conditioning and process industries the following advantages over the earlier two-bed system: it requires simpler and potentially less costly equipment; it is capable of more complete deionization than the two-

Leopold

GLAZED FIRE CLAY TILE FILTER BOTTOM

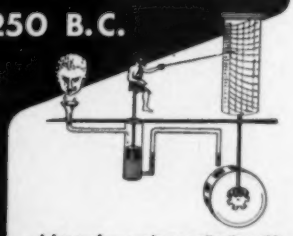
• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solution • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.

Write today for complete information

F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

WATER at WORK
250 B.C.



A far cry from modern applications, this unique time piece known as the Water Clock of Ctesibius was operated by tears flowing from the eyes of a statue. The Pointer descended once in 24 hours, actuated by an automatic siphon.

for excellence in MODERN water treatment equipment — gravity and pressure filters — recirculation apparatus

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER
MANUFACTURING CO.
607 COLUMBIA AVE., DARBY, PA.

oed system could produce; it is easier to operate, reduces rinse requirements and costs less to regenerate; and it permits constant maintenance of a neutral pH during deionization.

Apparatus using the Monobeds as their active principle may record the electrical conductivity of the effluent water on a milliammeter as in indicator of deionizing capacity of the resin. The resin also changes color upon exhaustion of deionizing capacity and the capacity of the bed may be watched visually through sight glasses in the apparatus.

To obtain further information on this new ion exchange resin and equipment which uses it, mail a Reader Service Card on which is entered the key number of this item and your name and address.

Yeomans Increases Turbine Equipment Co. Coverage

Yeomans Brothers Co., Chicago, Ill., has announced that Turbine Equipment Co., will represent them in several counties of upper New York State as well as New York City.

Turbine Equipment Co., will handle the complete Yeomans line of pumps for building municipal and industrial applications, and Yeomans systems of waste treatment for municipalities and industrial plants.

Chicago Bridge & Iron Move San Francisco Office

The San Francisco sales office of the Chicago Bridge & Iron Co., was moved from 22 Battery St., to Room 617, 200 Bush Street. The telephone number remains the same as at the old address.

L. A. Elsener is manager of the San Francisco office and is assisted by K. W. Lange, contracting engineer.

811

Automatic Controls for Variable Speed Drives

Link-Belt Co., Chicago, Ill., has announced a new line of Automatic Speed Controls for the P.I.V. (Positive Infinitely Variable) variable speed drive to meet the growing demand throughout industry for positive, quick-acting, automatic control of rotary motion.

The automatic control senses variations quickly and immediately adjusts the P.I.V. drive by the precise amount

Model NSH at Sumter, S.C.—3 to 6 cu. yd. per hour capacity

MAKE SLUDGE DISPOSAL PROFITABLE

A Royer Sewage Sludge Disintegrator will prepare your sludge for sale at less than the cost of disposal. Hauling, burning or burying it are time-consuming and costly operations. Sludge processed by the Royer Sludge Disintegrator becomes a readily marketable fertilizer, in great demand by golf clubs, florists and nurserymen. Even if you gave it away, you would be money ahead — selling it, you establish a source of additional revenue.

Sludge from the drying beds is shovelled into the hopper of the Royer and is shredded, mixed, aerated and further dried with all stones and trash removed. The finished product can be discharged direct to pile, bags or truck.

Royers are made in a variety of sizes and models—write for full information.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

STOP WATER SEEPAGE SEWAGE CORROSION

WITH FORMULA No. 640

a clear liquid penetrating (1"+) sealer for concrete and masonry preventing water absorption and reducing the action of acids. Holds 12' hydrostatic head. Use our Hayproc Rubberized Enamel for color on walls and floors—not affected by concentrated acids, alcohol, oil, or traffic abrasion.

30 OTHER PRODUCTS

Write for technical data.

Haynes Products Co., Omaha 3, Nebr.

See our file in Sweet's

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.

Sales Office: 320 Cedar St., New York, N. Y. | Factory: Medford, N. J.

Pioneer Producer of GREENSAND ZEOLITE MINERALS

Detectron 505
PIPE DETECTORS

FIRST WITH A METAL CASE
FIRST WITH SHIELDED LOOPS
FIRST WITH "SURE GRIP" HANDLE
FIRST WITH LIFETIME GUARANTEE

The new DETECTRON Model 505 locates, traces and centers pipes and cables with speed and accuracy. Small, compact, lightweight—with HEAVY DUTY PERFORMANCE.

- HIGHER QUALITY
- LONGER LIFE
- LOWER PRICE

TRIPLE VALUE!

For Complete Information Write for Folder S-N

THE Detectron CO.
5637 CAHUENGA BLVD. NORTH HOLLYWOOD, CALIF.

LEADITE
The Pioneer Self Caulking Material for C. I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal Size of Pipe, In.	Depth of Lead Required for Leadite, In.	Approx. Weight of Leadite per Joint, Lbs.	Depth of Lead Required for Poured Joint, In.	Approx. Weight of Poured Joint, Lbs.
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

needed to compensate for each variation. These controls can be used for control of temperature, velocity, pressure, liquid levels and flow of materials that must be held to narrow limits despite variations in operating conditions.

Actuated in many ways—by floating rolls and follower rolls, by floats and pressure diagrams—these new controls automatically provide the necessary amount of electrical, hydraulic, pneumatic or mechanical energy to adjust the P.I.V. output by motor, piston or linkage.

To obtain further information regarding this new control, use a Reader Service Card on which is entered the above key number and your name and address.

LITERATURE AND CATALOGS

812
TANK CORROSION PROTECTION

Koppers Co., Inc., Tar Products Division, Pittsburgh, Pa., in its latest bulletin, describes in detail the use of the corrosion protection product **"Bitumastic."** This bulletin explains how Bitumastic was used to preserve the inside of the 3,000,000 gallon water storage tank for the Marin Municipal Water District, San Rafael, Calif. Complete details of application, thickness of coating, photographs showing tank after application, and the qualities of Bitumastic are also included.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

813
ELECTRIC MOTORS

U. S. Electrical Motors, Inc., Los Angeles, Calif., has just published a complete catalog on **U. S. Motors, Asbestos - Protected.** Bound in a sturdy grey leatherette cover, it encompasses their complete line of motors along with sections on repair parts, controls and ordering information. The catalog is profusely illustrated throughout with beautiful four-color photographs of the motors, cross sectional and diaphanous views of motor and gear operations, typical installations, and diagrams. Featured in the general section is an explanation of the protection afforded by U. S.'s Asbestic process that protects the

CONTROL
Gas Pressures

From Digestion Tanks with NORWALK REGULATORS and CHECK VALVES

Handling sewage gas from digestion tanks is one of Norwalk Valve's activities in the manufacture of gas pressure control equipment. Stock items include check valves, pressure relief valves, regulators, all sizes and pressures. Illustrated are the Norwalk Disc Check Valve and the "Meter Cop" (a Norwalk exclusive).

DESIGN AND FABRICATION OF SPECIAL UNITS

Any unusual problems can be solved by our design and fabrication of special units. Norwalk products are made with ASTM and other materials required by contract specifications.

Outline your requirements in a note to us. We'll be glad to suggest designs and special equipment. We'll also send along a catalogue of our complete line of gas control equipment.

NORWALK VALVE COMPANY
33 RAILROAD AVENUE
SOUTH NORWALK, CONN.

STOP
JOINT LEAKAGE
USE
CARSON CLAMPS
With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.
Write for Prices.
Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

ANTHRAFILT
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A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

windings from heat so the insulation will not burn or carbonize. Also explained by diagrams and text is the Lubriflush system of bearing lubrication which permits years of service without re-lubrication and a comparison diagram showing the varying amounts of grease necessary to properly lubricate different types of bearings.

In a special section, the U. S. explosion-proof motor (featuring the sealed inner chamber and flame-arresting seal) is shown and described in detail. Another item of interest in this complete electrical motor reference manual is the description of the Verticlosed motor that was especially developed for deep well water turbine pumping. Complete rating charts, size and speed variation tables are also included.

To obtain a copy of this unusual catalog, use a Reader Service Card entering the key number and your name and address.

814
WATER CLARIFIERS

Graver Water Conditioning Co., New York, N.Y., has just made available a new bulletin on **Water Clarifiers and Cold Process Softeners.**

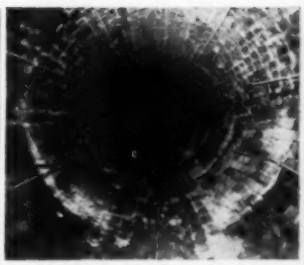
The bulletin graphically describes the design, operation and features of the Graver unit of this type, known as the Reactivator, with explanations in tabular form for greatest clarity. Introductory sections of the bulletin concisely explain the principles and chemistry of cold process water treatment, and compare the Graver Reactivator with other methods of water purification. Various accessories are also described, and the bulletin is profusely illustrated with diagrams and installation photographs.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

815
AUTOMATIC CONTROL VALVES

Ross Valve Mfg. Co., Troy, N.Y., has just published a 119 page catalog on **Automatic Control Valves and Specialties.**

This catalog is complete with actual photographs of the line of valves manufactured by Ross covers altitude valves, back pressure valves, check valves, electric remote control valves, float valves, pilot valves, globe valves, reducing or regulating valves, relief or back pressure valves, reverse flow valves, etc. Pipe lay-



"GUNITE" STRENGTHENS EXISTING SEWERS

Reinforced "GUNITE" lining has been successfully used on brick, tile and concrete sewers, restoring them to greater than originally designed strength.

Erosion of mortar joints and dislodged bricks made many sections of the above 65-year-old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining of varying thickness in this sewer without opening the streets. Sewer service was maintained by installing temporary flumes and also by by-passing through relief sewers.

This job, and many other types of "GUNITE" jobs which we have done, are illustrated and described in our new 64-page general bulletin C2400. A request on your letterhead will bring you a free copy by return mail.

We will be pleased to cooperate with you on any of your problems.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

Starting Point
for Economical Water Treating Plants

Increase throughput capacity—in your present water treating plant without additional construction costs. Coagulate with the aid of N-Sol Process (activated silica).*

N-Sol produces large, tough and heavy floc. It shortens settling time; often lengthens filter runs.

Before you complete designs on new or enlarged filtration plants, get file #52-8 on "N-Sol Processes."

*made by reacting "N" Silicate with ammonium sulphate, chlorine, alum or sodium bicarbonate.

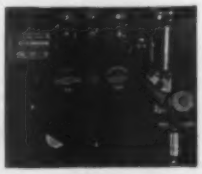
PHILADELPHIA QUARTZ COMPANY
1166 Public Ledger Bldg., Philadelphia 6, Pa.

N-SOL Coagulating Aids

HELLIGE
TURBIDIMETER
A TURBIDIMETER WITHOUT STANDARDS
Accurate • Foolproof • Universal

WRITE FOR CATALOG No. 8000
HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.

ROTO-TROL



TYPE "A"

Type "A" Roto-Trol operates from the pressure in the pump discharge line, at the pump house. The electric time delay prevents starting or stopping due to surges. It also protects deep well turbines from damage due to back-spin. . . . *Type "A" Multi-Pump Roto-Trol* is designed for two or more pumps discharging into the same discharge pipe. Adjusted time delays compensate for additional pumping friction and surges when second pump starts or stops.

WRITE FOR PERFORMANCE AND ENGINEERING DATA
Water Levels Control Division
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

out's of the various valves are shown by means of schematic diagrams as well as cross-sections of the valves. Also covered are portable fire hydrants, hydraulic booster pump, water motor and feed water filters.

To obtain a copy of this catalog, use a Reader Service Card on which is entered the above key number and your name and address.

816
CATHODIC PROTECTION

Electro Rust-Proofing Corp., Belleville, N.J., has announced the publication of a new booklet entitled **"Dollars and Sense of Cathodic Protection for Transmission and Distribution Pipe Lines."** The booklet contains data on cathodic protection case histories as well as factual information on the economics involved. Also included is a discussion of the requirements for successful cathodic protection together with a statement of the services offered by Electro Rust-Proofing.

To obtain a copy of this booklet, use a Reader Service Card on which is entered the above key number and your name and address.

817
WALKING BEAM FLOCULATOR

Stuart Corp., Baltimore, Md., has just released a bulletin on their **"Walking Beam" Floculator.** This bulletin gives the background and a short history on the development of the "Walking Beam" Floculator. Photographs show several typical installations and particularly featured is the one selected at Cornell University for its new filter plant modernization program.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

818
VALVES & LIQUID LEVEL CONTROLLERS

Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Philadelphia, Pa., has issued a series of bulletins on their **Belfield Float Valves, Belfield Regulating Valves** and **Belfield Liquid Level Controllers.**

In the bulletin on Float Valves descriptive photographs and schematic diagrams of the quick opening regulating valves, iron body bronze mounted or all bronze; semi-balanced regulating valve; rotary shaft regulating valves and float or tank valves are included. Also, a page is

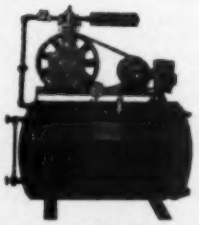
M-SCOPE Pipe Finder
LIGHTWEIGHT MODEL
One Man Operation
On Every Application

HIGHLY EFFICIENT
IMMEDIATE SHIPMENT

Catalog No. 25M On Request

Free Demonstration and Operating Instructions
JOSEPH G. POLLARD CO., INC.
Pipe Line Equipment
New Hyde Park New York

KEEP
PUMPS PRIMED
FOR INSTANT USE



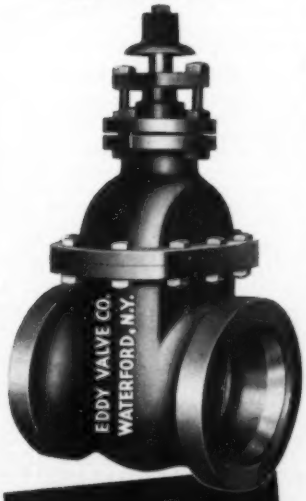
No. 2V—APCO PRIMER

WITH V-APCO *AUTOMATIC PRIMER*
OR
APCO TANK PRIMERS

AIR RELEASE VALVES
AIR & VACUUM VALVES

VALVE & PRIMER CORP.
127 N. DEARBORN ST.
CHICAGO 2, ILL.

Bury it and Forget it!



EDDY
DOUBLE GATE VALVE

If you will think before buying a valve—you can eliminate thinking of it forever after. When you think of valves—think of the years of time and effort we have put into giving you a smooth-operating, trouble-free valve. Think of the progressive water works men who have relied on Eddy Valves for years—then specify and insist on getting Eddy Valves—you can bury them and forget them.

EDDY
VALVE COMPANY
WATERFORD NEW YORK
A subsidiary of James B. Clow & Sons

devoted to pressure regulator, reducing valve disc-plugs and dimension charts are given for the various types of regulating and float valves.

The bulletin on Regulating Valves describes fully the operating principle of the Belfield Single Seat Pilot Balanced Regulating Valves with schematic drawings and dimension charts. It also contains information on the Slip-Stem and Rotary Shaft types for steam, air, gas, and liquids.

Both Direct-Connected and Air Actuated Controllers are illustrated and described in the bulletin on Liquid Level Controllers. Details of the special construction features and typical applications along with many schematic drawings, diagrams and photographs are included, with capacity charts, flow characteristics, pressure-temperature rating charts and dimensions.

To obtain a copy of these very informative bulletins, use a Reader Service Card on which is entered the above key number and your name and address.

819

VALVES & SHOCK ABSORBER

R-S Products Corp., Philadelphia, Pa., has just issued two new bulletins on their **50-lb. Valves** and **Heyden Liquid Shock Absorbers.**

The first bulletin is a 12 page, 2 color catalog that introduces a new line of 50 lb. narrow face-to-face valves, designed particularly for rugged hydraulic service. The various types of valves and controls are described and illustrated. Also illustrated are the stuffing boxes, which include plain, lubricated, lubricated with purge connections and the rotary seal. Advantages of the valves, a description of the rubber seat, special metals together with dimensions and weights provide essential engineering information.

The second bulletin on Heyden Liquid Shock Absorbers features four models of a compact shock absorber which eliminate shock and hammering in pipe lines carrying water or petroleum products. Description, application, installations, instructions and list prices are included.

To obtain copies of these new bulletins, use a Reader Service Card on which is entered the above key number and your name and address.

820

GRIT CHAMBERS

American Well Works, Aurora, Ill., has just published a Technical Supplement on **American Camp Grit Chambers.** This technical supplement discusses the new method of Grit

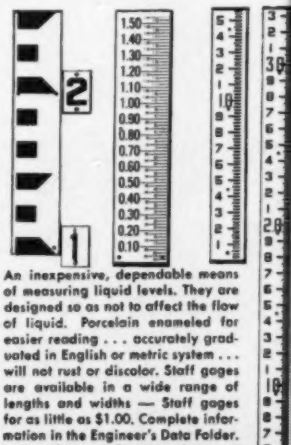
ENGINEER'S FILE ON HYDROGRAPHIC INSTRUMENTS

STEVENS
HYDROGRAPHIC INSTRUMENTS

A wide range of precision measuring instruments to record and indicate head, flow, and totalize flow; for waterworks, sewerage, irrigation and industrial uses. New, low cost methods of liquid level recording.

These methods and instruments for all liquid measuring problems are listed in a complete Engineer's Data folder for your convenience. This information folder is *FREE* and can be had by filling in the coupon below. The folder includes data on instruments to record fluctuations of liquids in oil production, stream gaging, deep wells, sewage, irrigation, etc., both accurately and economically.

STAFF GAGES



An inexpensive, dependable means of measuring liquid levels. They are designed so as not to affect the flow of liquid. Porcelain enameled for easier reading . . . accurately graduated in English or metric system . . . will not rust or discolor. Staff gages are available in a wide range of lengths and widths — Staff gages for as little as $1.00. Complete information in the Engineer's Data Folder.

Leupold and Stevens pioneered the field of water level recording 43 years ago, and since then have developed precision measuring instruments of all types and descriptions to meet many specific needs.

Write for the complete file. There may be a measuring device that exactly suits your specific requirements. Use the coupon below.

Please send me the *Engineer's Data Folder* with complete information on Hydrographic instruments.

Name_____

Address_____

City_____ **State**_____

LEUPOLD & STEVENS INSTRUMENTS, INC.
4445 N.E. Glisan • Portland 13, Oregon

FOR SALE

2,500 ft. ..... 24" Used Cast Iron Water Main Pipe B&S
2,000 ft. ..... 18" Used Cast Iron Water Main Pipe B&S
324 ft. ..... 18" New Cast Iron Water Main Pipe B&S
2,500 ft. ..... 14" Used Cast Iron Water Main Pipe B&S
900 ft. ..... 12" Used Cast Iron Water Main Pipe B&S

JOB LOT!

NEW CAST IRON WATER MAIN FITTINGS

Will sell one fitting or entire quantity below market price.

BELL & SPIGOT CAST IRON WATER MAIN PIPE

4 lengths	—	30"	Class 250	12' 6" each length
16 "	—	18"	Class 250	18' 0" "
1 "	—	16"	Class 150	12' 0" "
1 "	—	16"	"	9'11½" "
1 "	—	16"	"	9' 6" "
1 "	—	14"	"	6' 3" "
1 "	—	12"	"	4' 0" "
1 "	—	10"	"	15' 0" "
1 "	—	8"	"	4' 4" "

CLASS D BENDS

6	—	30"	Bell & Spigot	11¼	Degree
4	—	24"	"	90	"
2	—	24"	"	45	"
7	—	18"	Bell & Bell	22½	"
2	—	18"	"	11¼	"
28	—	16"	Bell & Spigot	90	"
11	—	14"	"	45	"
2	—	14"	"	22½	"
66	—	10"	Bell & Bell	90	" L.B.
34	—	10"	"	45	"
72	—	10"	Bell & Spigot	22½	"
1	—	8"	Bell & Bell	90	"
1	—	8"	Bell & Spigot	45	" L.B.
2	—	6"	"	90	"
2	—	4"	Bell & Bell	90	" L.B.
1	—	3"	Bell & Spigot	90	" L.B.

CLASS B INCREASERS

1	—	—16" x 8"	Bell & Spigot	L.E.D.

REDUCERS

1	—	—24" x 18"	Class B	Bell & Spigot	S.E.D.
2	—	—24" x 16"	"	"	"
1	—	—24" x 14"	Class D	"	"
1	—	—20" x 14"	Class B	"	"
4	—	—20" x 16"	Class D	"	"
2	—	—18" x 16"	Class B	"	"
2	—	—18" x 14"	"	"	"
1	—	—18" x 14"	Class D	Bell & Bell	S.E.D.
1	—	—18" x 10"	Class B	Bell & Spigot	"
1	—	—18" x 8"	Class D	Bell & Bell	"
1	—	—18" x 8"	"	Bell & Spigot	"
2	—	—16" x 8"	"	Bell & Bell	"
1	—	—16" x 10"	"	Bell & Spigot	"
1	—	—16" x 8"	Class B	"	"
1	—	—14" x 8"	"	Spigot & Spigot	cc.
1	—	—10" x 8"	"	"	"

WATER MAIN SLEEVES

3	—	16"	Class B	Tapped 2
10	—	12"	"	Ditto
20	—	8"	"	Ditto
27	—	6"	"	Ditto
15	—	16"	Class D	Not Tapped
1	—	10"	"	"
1	—	8"	"	"

WATER MAIN TEES, CLASS D

2	—	—36" x 6"		Bell Ends
1	—	—24"		"
1	—	—24" x 24" x 16"		"
1	—	—24" x 24" x 10"		"
1	—	—20" x 20" x 16"		"
1	—	—20" x 20" x 14"		"
4	—	—18" x 18" x 14"		Bell-Spigot-Bell
1	—	—18" x 18" x 12"		"
1	—	—18" x 18" x 10"		Bell-Spigot-Flgs. Bell Ends
11	—	—18" x 18" x 8"		Bell-Spigot-Bell
20	—	—18" x 18" x 6"		Bell Ends
1	—	—18" x 18" x 6"		Bell-Spigot-Bell
3	—	—16" x 16" x 16"		Bell Ends
1	—	—16" x 16" x 14"		"
3	—	—16" x 16" x 10"		Bell-Spigot-Bell
1	—	—16" x 16" x 8"		"
20	—	—16" x 16" x 6"		Bell Ends
4	—	—14" x 14" x 12"		"
1	—	—14" x 14" x 10"		Bell-Spigot-Bell
1	—	—14" x 14" x 8"		"
20	—	—12" x 12" x 12"		Bell Ends
2	—	—12" x 12" x 10"		Bell-Spigot-Bell
4	—	—12" x 12" x 8"		Bell Ends
1	—	—12" x 12" x 6"		"
2	—	—10" x 10" x 10"		"
1	—	—10" x 10" x 8"		"
1	—	—10" x 10" x 6"		Bell-Spigot-Bell
1	—	—8" x 8" x 8"		Bell Ends
1	—	—8" x 8" x 6"		Bell-Spigot-Bell
1	—	—6" x 6" x 6"		Bell Ends
63	—	—6" x 6" x 4"		Bell-Spigot-Spigot
6	—	—4" x 4" x 4"		Bell Ends

WATER MAIN CROSSES—CLASS D

6	—	—16" x 16" x 14" x 14"	Bell Ends
1	—	—12" x 12" x 6" x 6"	"
1	—	—12" x 12" x 10" x 10"	"
6	—	—12" x 12" x 4" x 4"	"

WATER MAIN LATERALS

1	—	— 4" x 4" x 4"	45-degree	Bell Ends

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removal by velocity regulation. It explains in detail that by use of the Camp grit channel and regulator the head loss may be chosen by virtue of design to accommodate plant hydraulic conditions. Lower head losses are possible due to the advantages inherent in the rectangular control section, constant velocity is maintained through all ranges of flow when a specific velocity is selected and regulator opening set accordingly, etc. Cross-section and exploded views of the channel, chamber and regulator are shown along with formulas and diagrams to show comparisons of normal head loss to depth of channel in feet and offsets in feet for calculations of channel size.

This new Technical Supplement may be obtained by mailing a Reader Service Card. Be sure to enter the key number and your name and address.

821

SEWER CLEANER

Expanding Sewer Machine Co., Nappanee, Ind., has available a catalog on **Sewer Cleaning Equipment.** This catalog contains data on the Expanding Root Cutter and Sewer Cleaner with a complete description on all accessories and parts available for use with the cleaner. Amply illustrated with photographs and drawings it shows how the cleaner works between manholes or inlets.

A partial list of users and reprinted letters from the experiences of users are included in the back of the catalog.

To obtain a copy of this catalog, use a Reader Service Card on which is entered the above key number and your name and address.

822

MAGNA-SIGHT FLOW GAUGE

Fischer & Porter Co., Hatboro, Penna., has issued a four page catalog folder on the **Magna-Sight Flow Gauge,** a low cost flow-rate measuring instrument designed especially for applications where accuracy within several percent is acceptable.

To obtain a copy of this catalog, mail a Reader Service Card on which is written, your name and address, and the above key number.

823

AIRVEYOR

Fuller Co., Catasauqua, Pa., have available a bulletin on **Airveyor,** the air conveyor. This bulletin shows practically all types of typical Airveyor installations. Diagrams of equipment used and typical flow patterns give a complete picture of the

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824
PORTABLE COMPRESSOR

Worthington Pump & Machinery Corp., Holyoke, Mass., has just issued a new bulletin on their **"60 Portable Compressor."** The bulletin, amply illustrated, shows the compressor with trailer cut-away diagrams. Complete specifications, dimensions and list of tools that may be operated simultaneously by this compressor are listed.

If you desire a copy of this bulletin, which is punched for ring binders, use a Reader Service Card on which is entered the above key number and your name and address.

825
CARSON CLAMPS

Carson-Cadillac Corp., Birmingham, Ala., has issued a bulletin on **Carson Bell-Joint Clamps.** This bulletin explains how these clamps automatically fit themselves to the joint because they can be adjusted to fit variations in outside bell circumference, to compress gasket uniformly regardless of variations and to make a snug fit around spigot, regardless of "out of round" and other variations in diameter. Photographic illustrations throughout show types of clamps and charts and on the back page are standard dimensions for cast iron pipe along with weights of cast iron pipe.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

826
DUST COLLECTORS

Omega Machine Co., Providence, R.I., has issued a new bulletin covering self-contained **Dust Collectors.** This bulletin points out the advantages of individual dust collecting units over central collecting systems. The buletin is illustrated with photographs and cross-section diagrams covering typical installations, principal dimensions of the collectors, a chart covering size, motor, speed, no. of bags, cloth area and CFM rating, and installations showing filling canopy, extension hopper and weight hoppers. Complete mounting instructions are also included.

For a copy of this buletin, mail a Reader Service Card with key number and your name and address.

827
AIROYMETRIC PUMPS

Milton Roy Co., Philadelphia, Pa., has just released a new bulletin on **Airoymetric and Airoy Pumps.** This two-color bulletin describes the "airoymetric" and "aiROY" air-cylinder powered chemical pumps, automatic chemical feed systems and automatic hydrostatic test systems. Illustrated with photographs of the pumps and cut-away line drawings, it shows in detail the operation of the patented Milton Roy double-ball check system. Typical lay-outs are shown for installation of feed systems and tables are included to show the air consumption of the pumps and capacity-pressure relationships.

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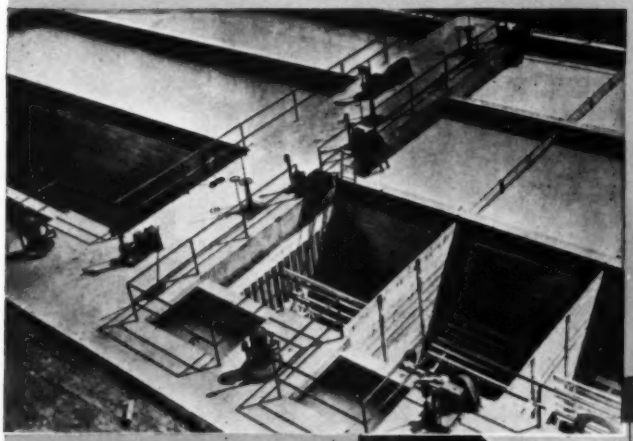
*Advertisers with * were represented in the May, 1950, Convention and Data Edition with catalog specifications copy. Please refer to that issue for additional information on behalf of their products.

CONTROLLED FLOCCULATION

by the Jeffrey FLOCTROL® PROCESS



Left—One of the six FLOCTROLS installed in water softening plant in Rawsonville, Michigan, supplying the Kaiser-Fraser assembly plant.

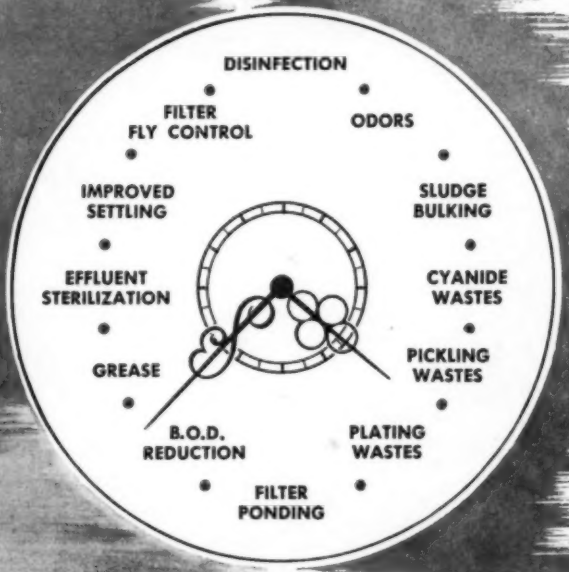
Below—One of the six settling basins in which the flocculated water is settled prior to filtration.

The Jeffrey FLOCTROL is available in two designs, either of which may be used in water or sewage treatment plants. For most efficient water and sewage treatment consult Jeffrey Sanitary Engineers.

JEFFREY

ESTABLISHED 1877

It's always time for CHLORINATION



W&T SEWAGE CHLORINATOR

Chlorination time at a modern sewage treatment plant knows no hour or season — it's always the right time to use this versatile tool in the solution of the numerous problems the average operator faces every day. For example, chlorination *controls odors* at Fort Wayne, Indiana; reduces *filter ponding* at Rotterdam, New York; and *sterilizes the effluent* of the Easterly Sewage Plant at Cleveland, Ohio.

Best of all, the advantages of chlorination aren't expensive. The average installation represents less than 1% of total plant cost.

Why not make it "chlorination time" in your plant now. Call your nearest W&T Representative for the benefit of over 35 years' experience in chlorination, a full line of equipment for every sewage plant need, the practical knowledge gained in making thousands of installations, and the availability of a nationwide service staff.

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